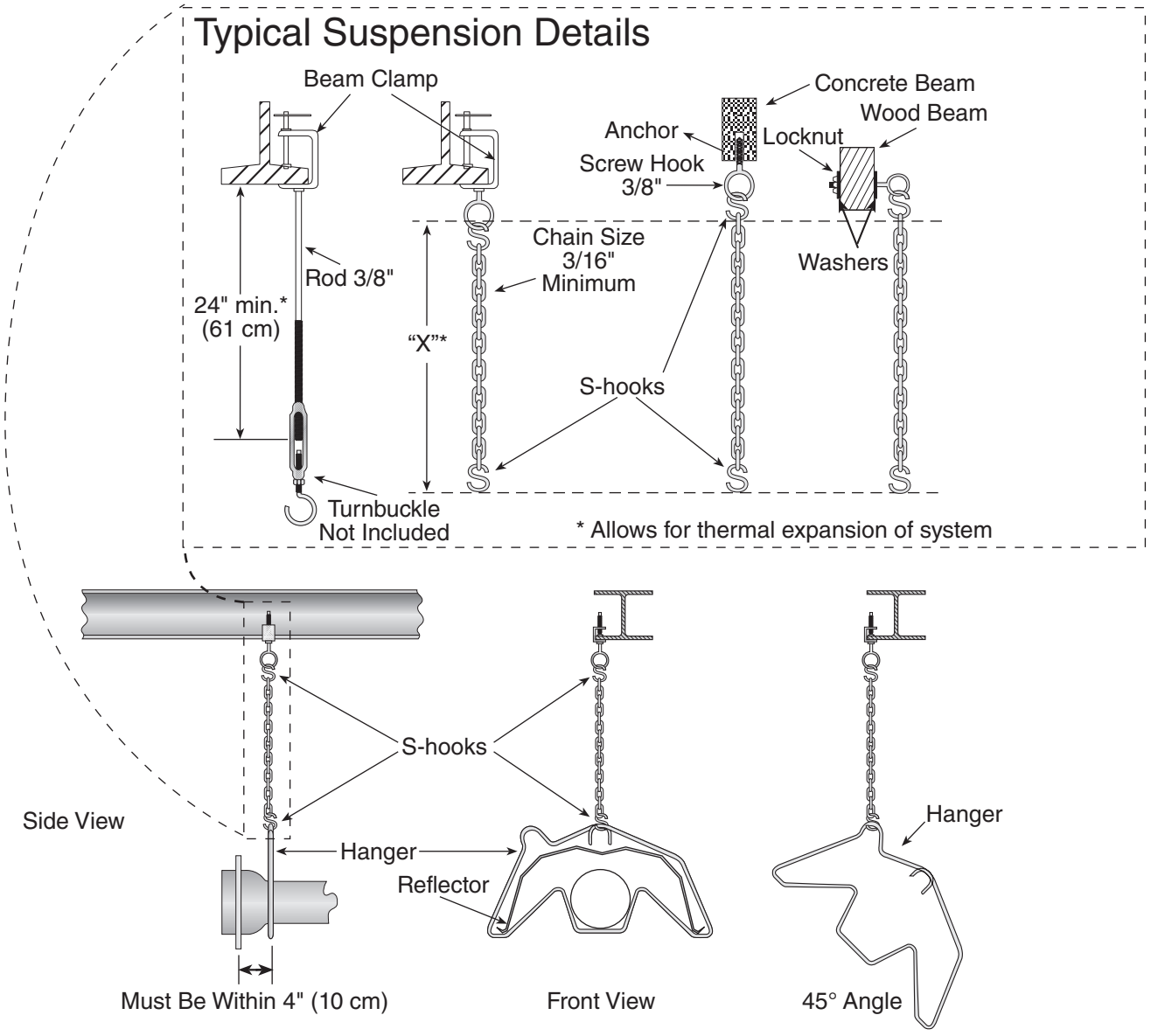
FIGURE 14: Critical Hanger Placement



Total Straight Length (both sides) or Length from U-Tube to U-Tube in a Double "U" Layout	Typical Expansion Each Side	Minimum "X" Length
0' - 50'	±1" (3 cm)	12" (31 cm)
51' - 60'	±2" (5 cm)	18" (46 cm)
61' - 80'	±3" (8 cm)	24" (61 cm)
81' - 100'	±4" (10 cm)	30" (76 cm)
101' - 120'	±5" (13 cm)	36" (91 cm)
121' - 140'	±6" (15 cm)	42" (107 cm)
141' - 160'	±7" (18 cm)	48" (122 cm)

If the installation requires a shorter suspension length than the minimum listed, the suspension length may be reduced by 6" (16 cm). In this case, tube clamps MUST be used at the two farthest hangers on each side of the burner. *See Page 16, Figure 15*.

Description	Part Number
S-Hook	91907302
Tube/Reflector Hanger	03090100

FIGURE 15: Linear Heater Assembly Overview

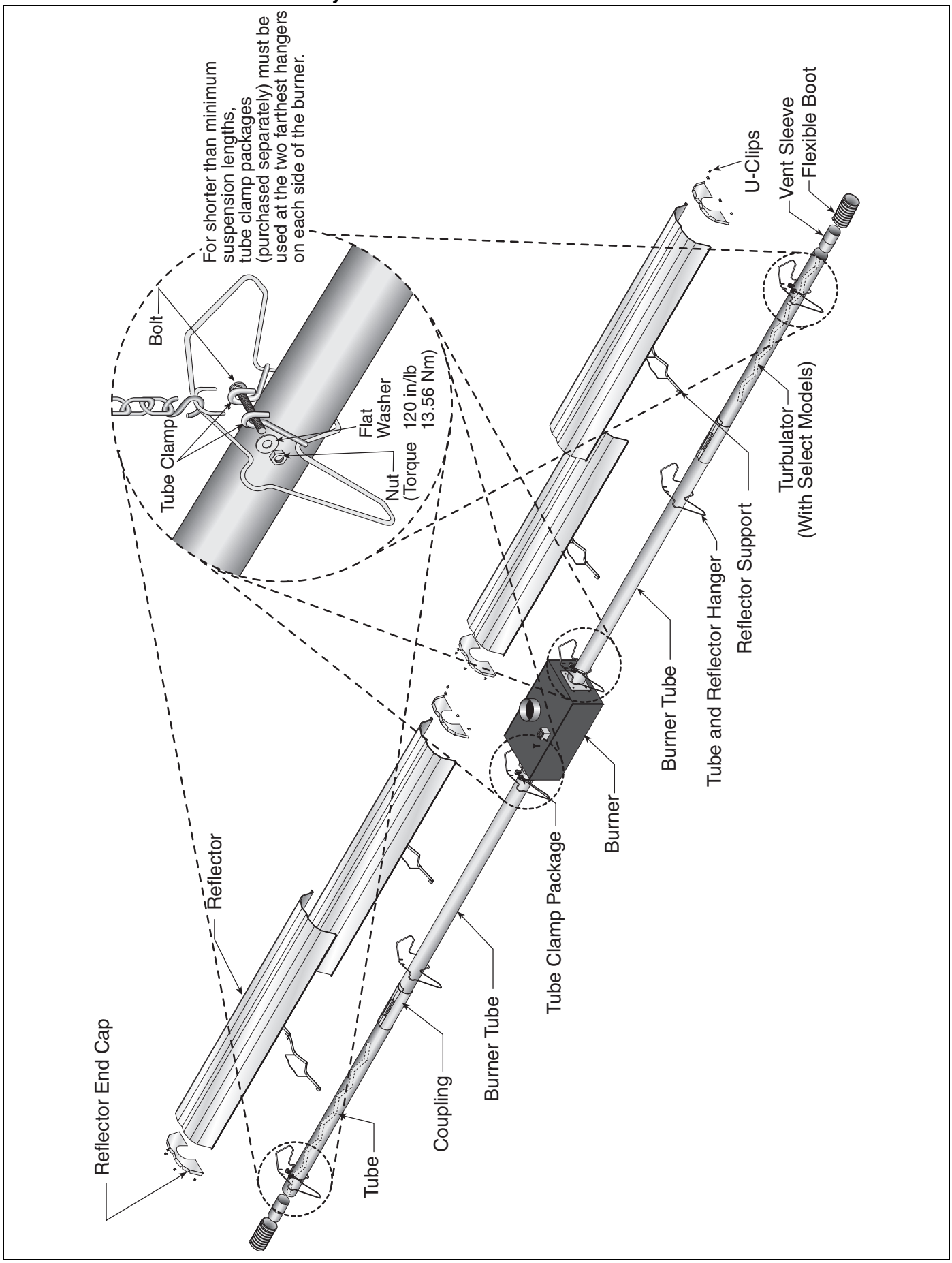


FIGURE 16: Linear Heater Layout Overview

Linear layouts showing one side. Use same measurements for the other side.

LEGEND

- Burner
- Reflector
- Tube
- Tube/Reflector Hanger
- Coupling Assembly

a = 14" (36 cm)
reflector width (not shown)

b = 2" (5 cm)
end cap to burner

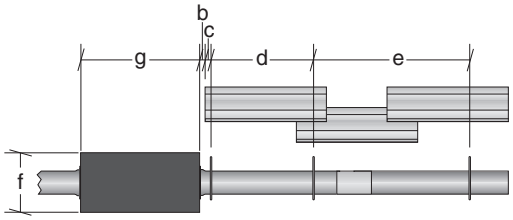
c = 2" (5 cm)
end cap to hanger

d = 7'6" (229 cm)
distance first hanger

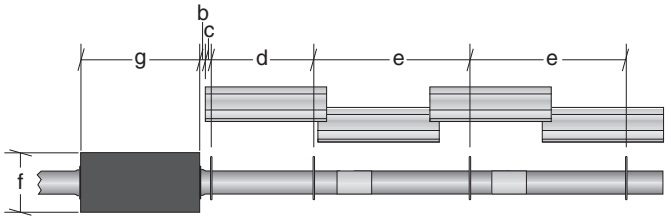
e = 10' (305 cm)
distance between hangers

f = 9.5" (24 cm)
burner height

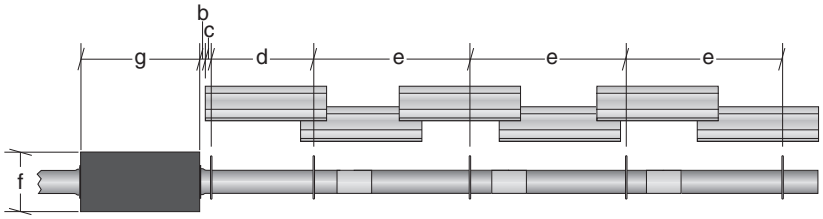
g = 23.5" (60 cm)
burner length



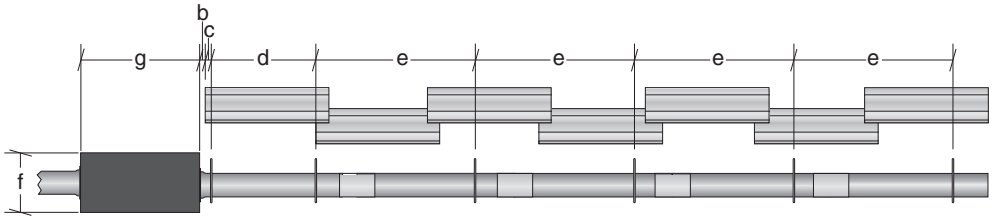
20' (6 m) Tube Length (Each Side)



30' (9 m) Tube Length (Each Side)

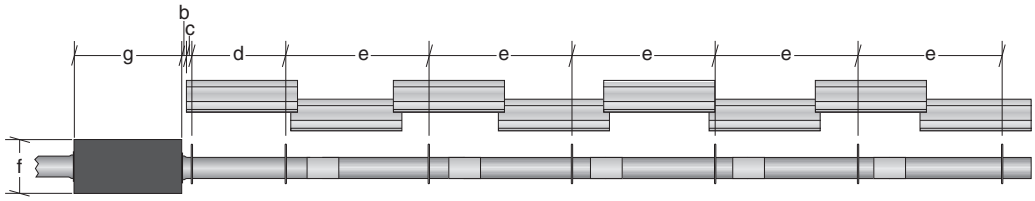


40' (12 m) Tube Length (Each Side)

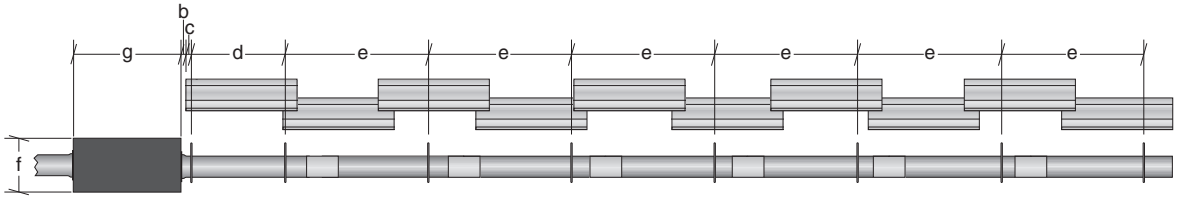


50' (15 m) Tube Length (Each Side)

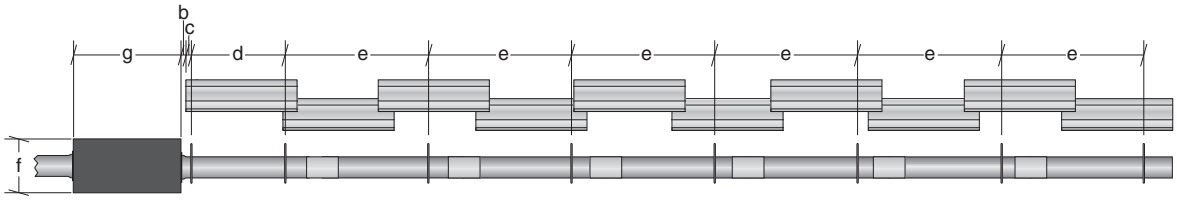
FIGURE 17: Linear Heater Layout Overview (Continued)



60' (18 m) Tube Length (Each Side)

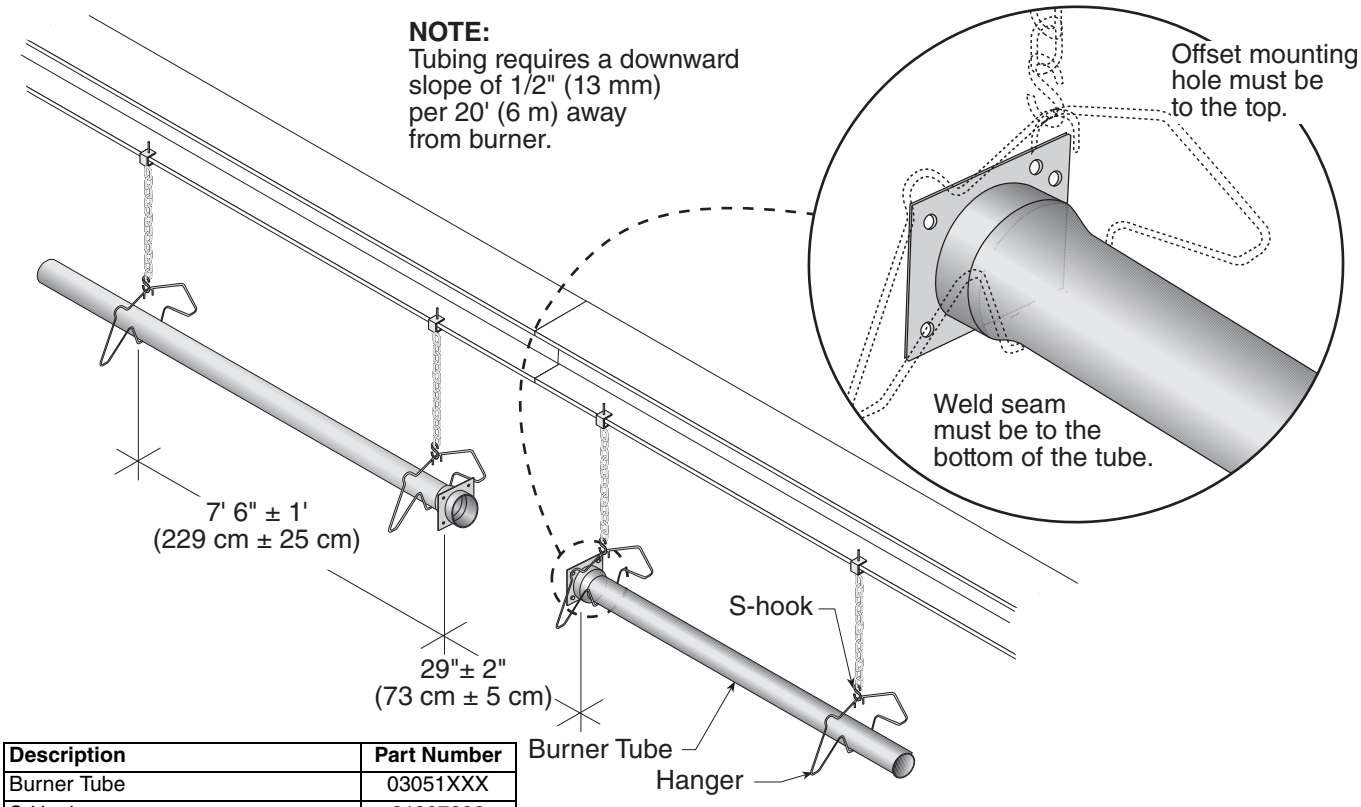


70' (21 m) Tube Length (Each Side)



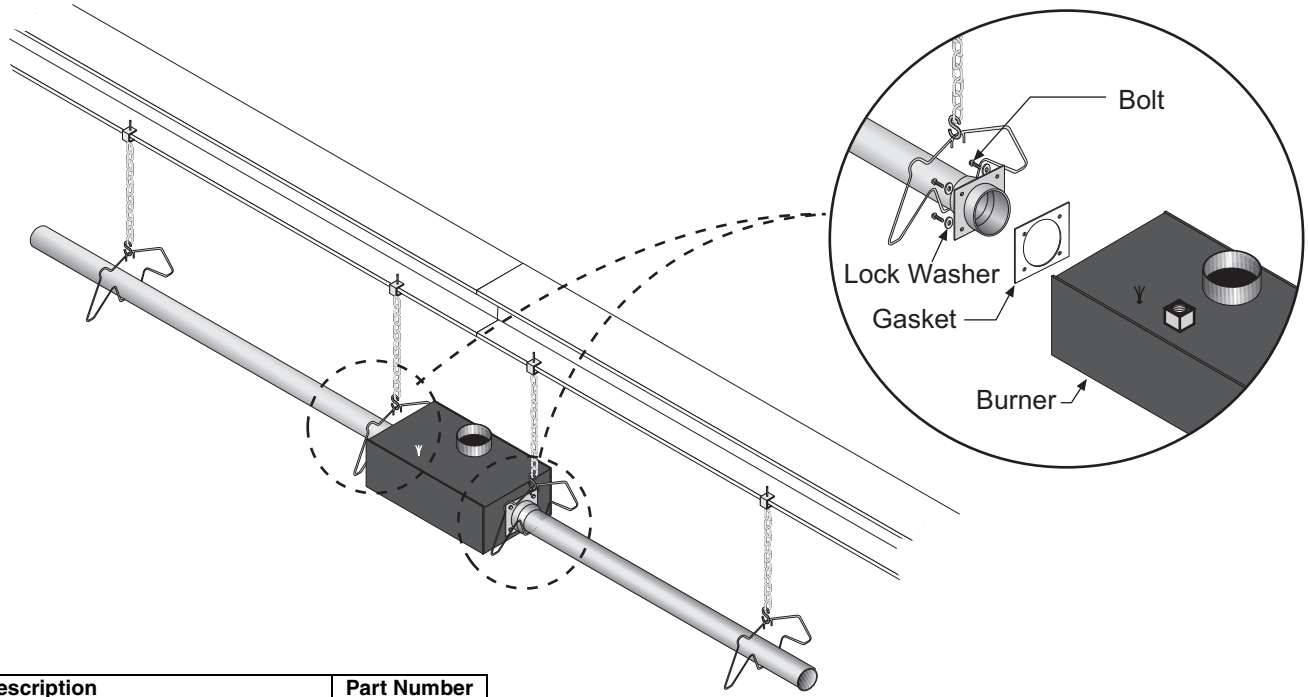
80' (24 m) Tube Length (Each Side)

Step 7.1 Burner Tube Installation


NOTE:
Tubing requires a downward slope of 1/2" (13 mm) per 20' (6 m) away from burner.
Offset mounting hole must be to the top.
Weld seam must be to the bottom of the tube.
7' 6" ± 1'
(229 cm ± 25 cm)
29"± 2"
(73 cm ± 5 cm)
S-hook
Burner Tube
Hanger

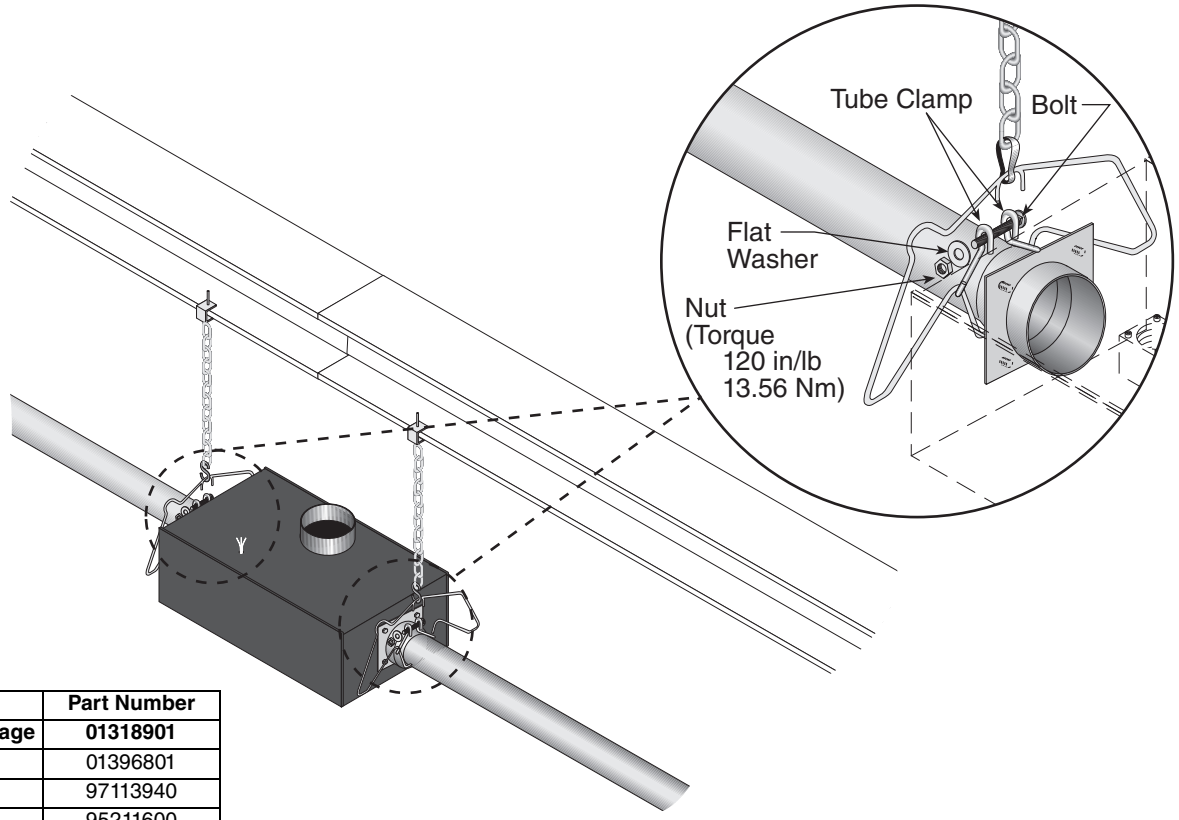
Description	Part Number
Burner Tube	03051XXX
S-Hook	91907302
Tube/Reflector Hanger	03090100

Step 7.2 Burner Installation



Description	Part Number
Bolt	94273914
Lock Washer	96411600
Gasket	02568200
Burner	090XXXXX

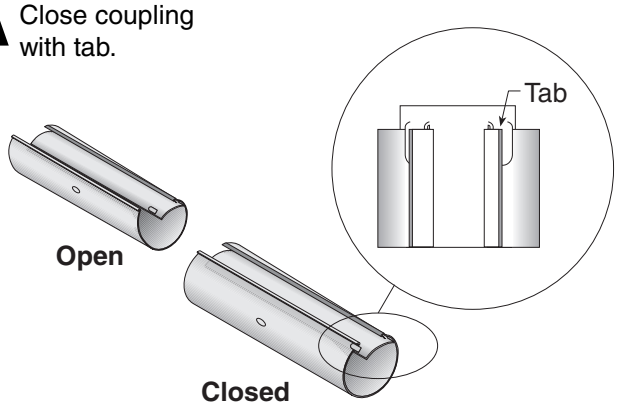
Step 7.3 Tube Clamp Package Installation



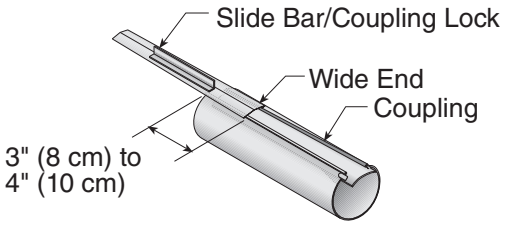
Description	Part Number
Tube Clamp Package	**01318901**
Tube Clamp	01396801
Bolt	97113940
Flat Washer	95211600
Nut	92113900

Step 7.4 Coupling and Tube Assembly

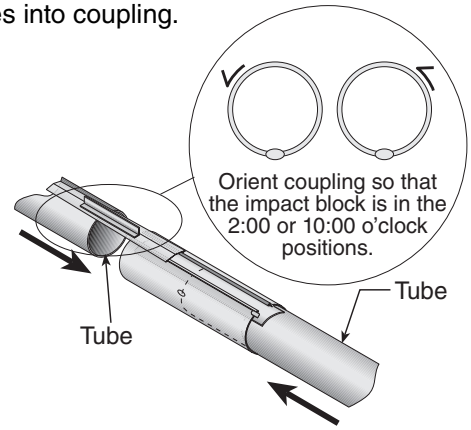
A Close coupling with tab.



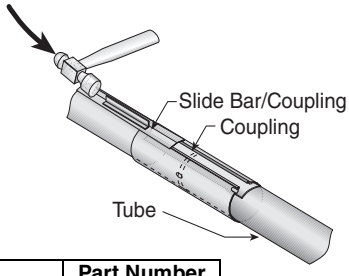
B Start Slide bar/Coupling Lock onto coupling.



C Insert tubes into coupling.



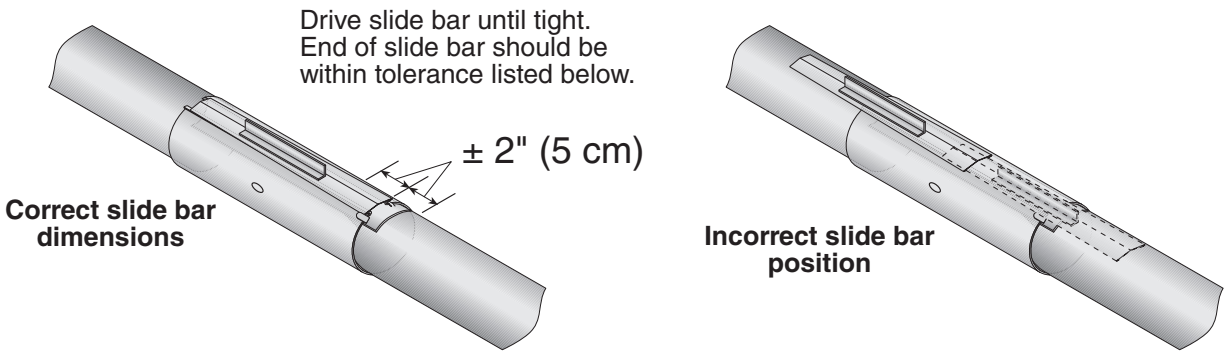
D Tighten coupling to join tubes.



Description	Part Number
Coupling	01329600
Slide bar/Coupling Lock	01329700
Tube	91409XXX

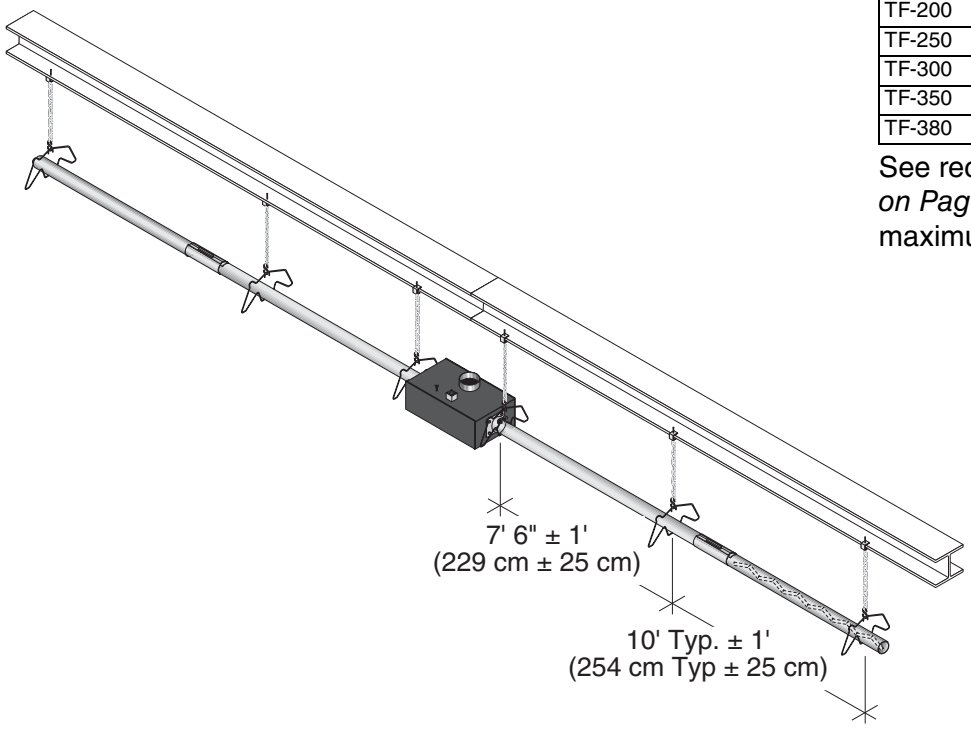
Step 7.4.1 Coupling and Tube Assembly (Continued)

Tighten slide bar as shown below



- **Repeat Step 7.4 A - D until all tubes are assembled.** ***See Page 21, Section 7.4.2*****.**

Step 7.4.2 Coupling and Tube Assembly (Continued)



Model	Minimum Tube Length Per Side
TF-120	20' (6 m)
TF-160	20' (6 m)
TF-200	30' (9 m)
TF-250	40' (12 m)
TF-300	50' (15 m)
TF-350	50' (15 m)
TF-380	60' (18 m)

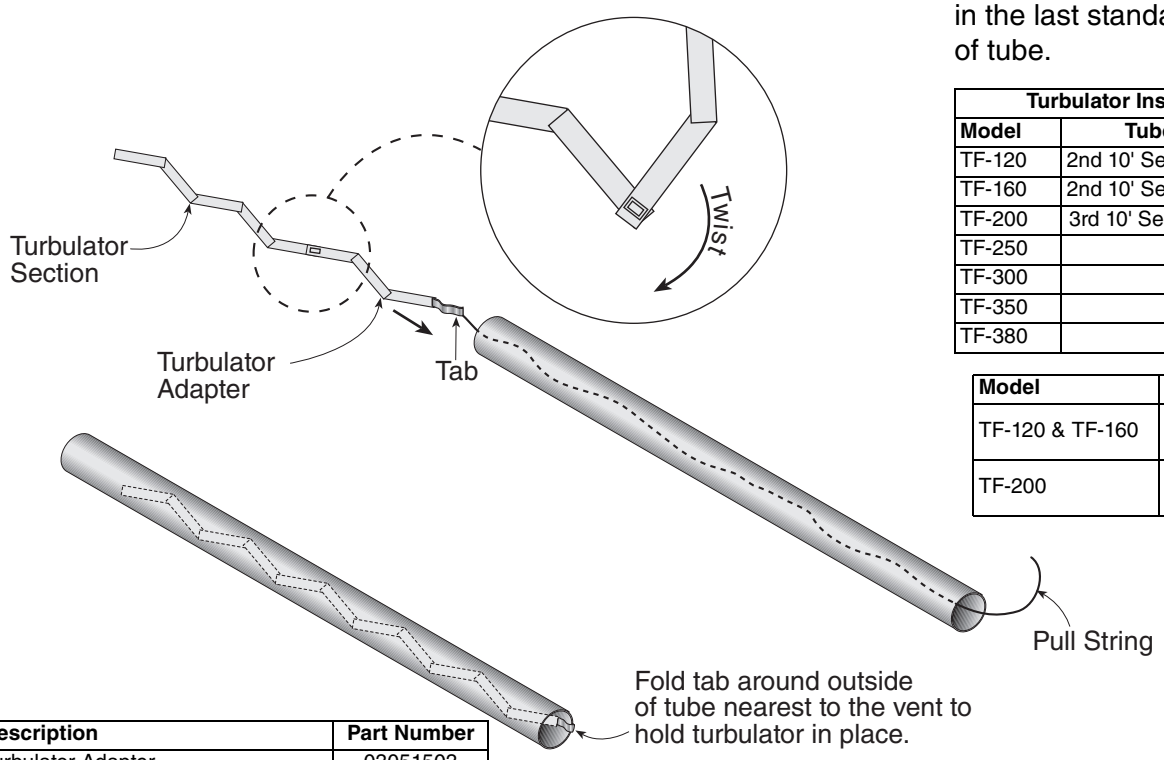
See recommended venting lengths *on Page 35, Section 9*, when using maximum tube lengths.

Step 7.5 Turbulator Installation

Turbulator must be installed in the last standard section of tube.

Turbulator Installation	
Model	**Tube Section**
TF-120	2nd 10' Section Each Side
TF-160	2nd 10' Section Each Side
TF-200	3rd 10' Section Each Side
TF-250	N/A
TF-300	N/A
TF-350	N/A
TF-380	N/A

Model	Each Side
TF-120 & TF-160	1 - 03051503 4 - 03051504
TF-200	1 - 03051503 2 - 03051504



Description	Part Number
Turbulator Adapter	03051503
Turbulator Section	03051504
Tube	91409XXX

7.6 Reflector Installation

⚠ WARNING

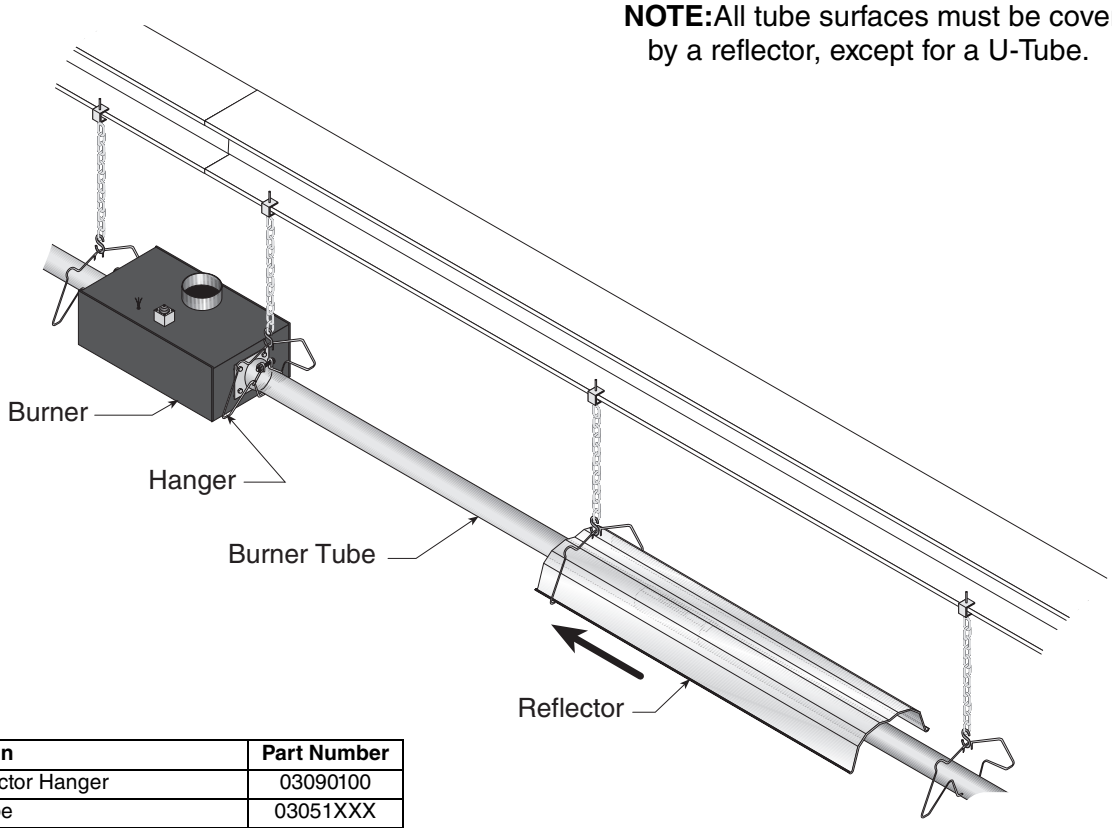
Fire Hazard

Support reflector with reflector hanger and support strap.

Reflector must not touch tube.

Failure to follow these instructions can result in death, injury or property damage.

NOTE: All tube surfaces must be covered by a reflector, except for a U-Tube.



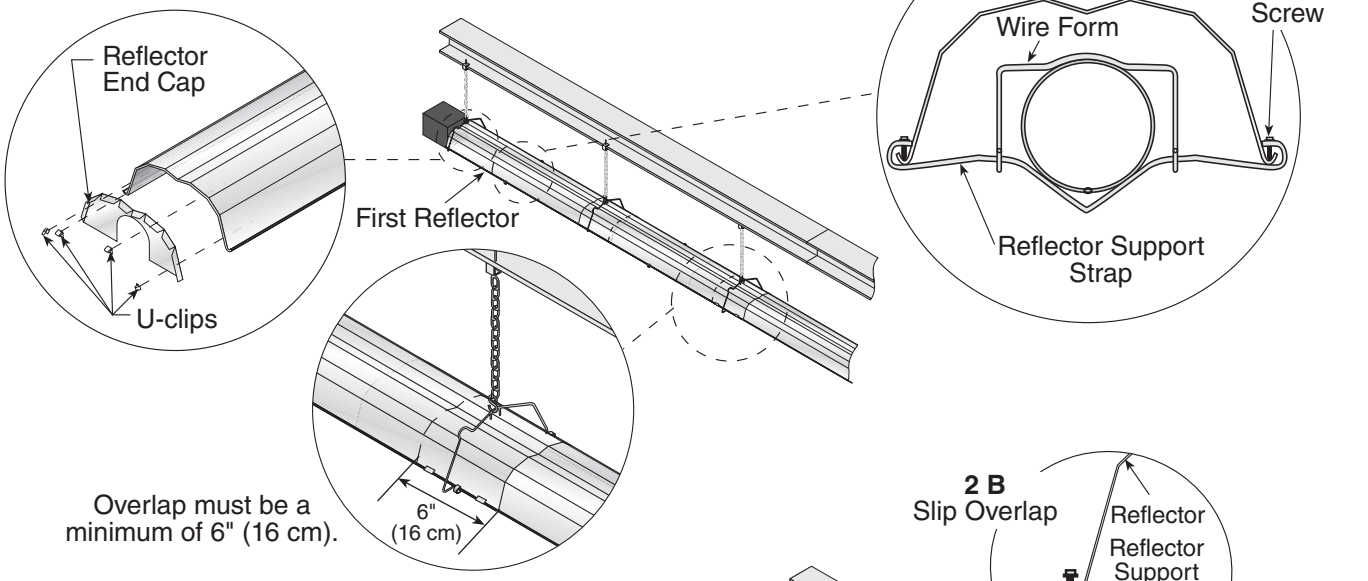
Description	Part Number
Tube/Reflector Hanger	03090100
Burner Tube	03051XXX
Reflector	02750303

Step 7.6.1 Reflector, U-Clip and Reflector Support Installation

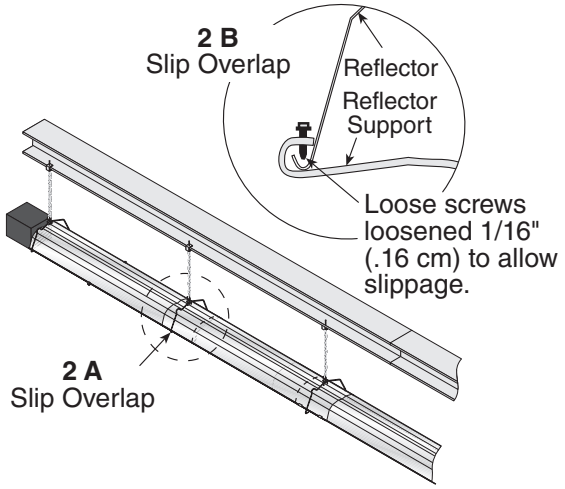
The pictorial drawings of the heater construction in *Section 7* are schematic only and provide a general guideline of where hangers, reflector supports and U-clips are to be installed.

To ensure proper expansion and contraction movement of the reflectors, a combination of U-clips and reflector supports are used. The positioning of reflector supports and U-clips depends on the individual installation. Use either pop rivets or sheet metal screws instead of u-clips when installing end caps and joint pieces in areas where impact and high wind may be a factor. The following rules must be observed.

1. The first reflector after the burner must be affixed in the middle of the reflector with a reflector support and tight screws.

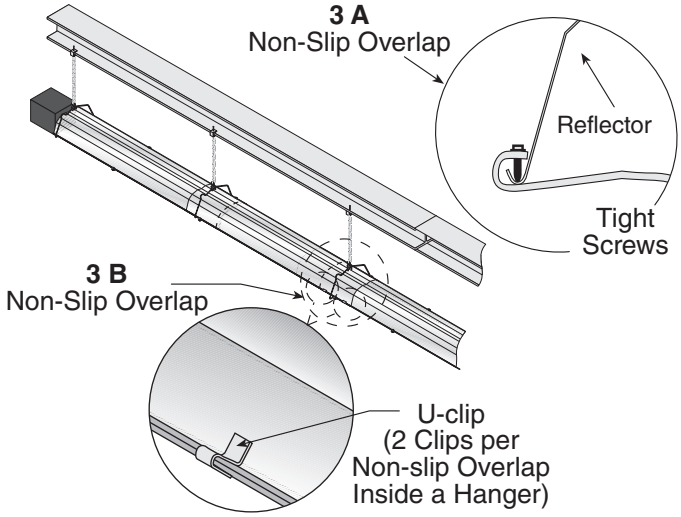


2. The overlap at the first and second reflector is a **slip overlap.** Thereafter, every third reflector joint is a slip overlap. A slip overlap is achieved by either:
   a.) both reflectors lay inside a hanger. (No reflector support needed.)
   b.) using a reflector support with loose screws at the reflector overlap.



3. The remaining reflector overlaps require a **non-slip overlap** connection. To affix the reflectors together in a non-slip overlap either:
   a.) use reflector support and tight screws.
   b.) if both reflectors lay inside a hanger, u-clips or sheet metal screws may be used.

   This section of three reflectors joined together must be affixed to the tube with at least one reflector support with tight screws.



Description	Part Number
Reflector Support Package	**03050010**
Wire Form	91908004
Reflector Support Strap	03050000
Screw #8 x 3/4	94320812
U-Clip Package	91107720
Reflector End Cap	027508XX

SECTION 8: OPTIONAL HEATER ACCESSORIES

⚠ WARNING

Cut/Pinch Hazard

Wear protective gear during installation, operation and service.

Edges are sharp.

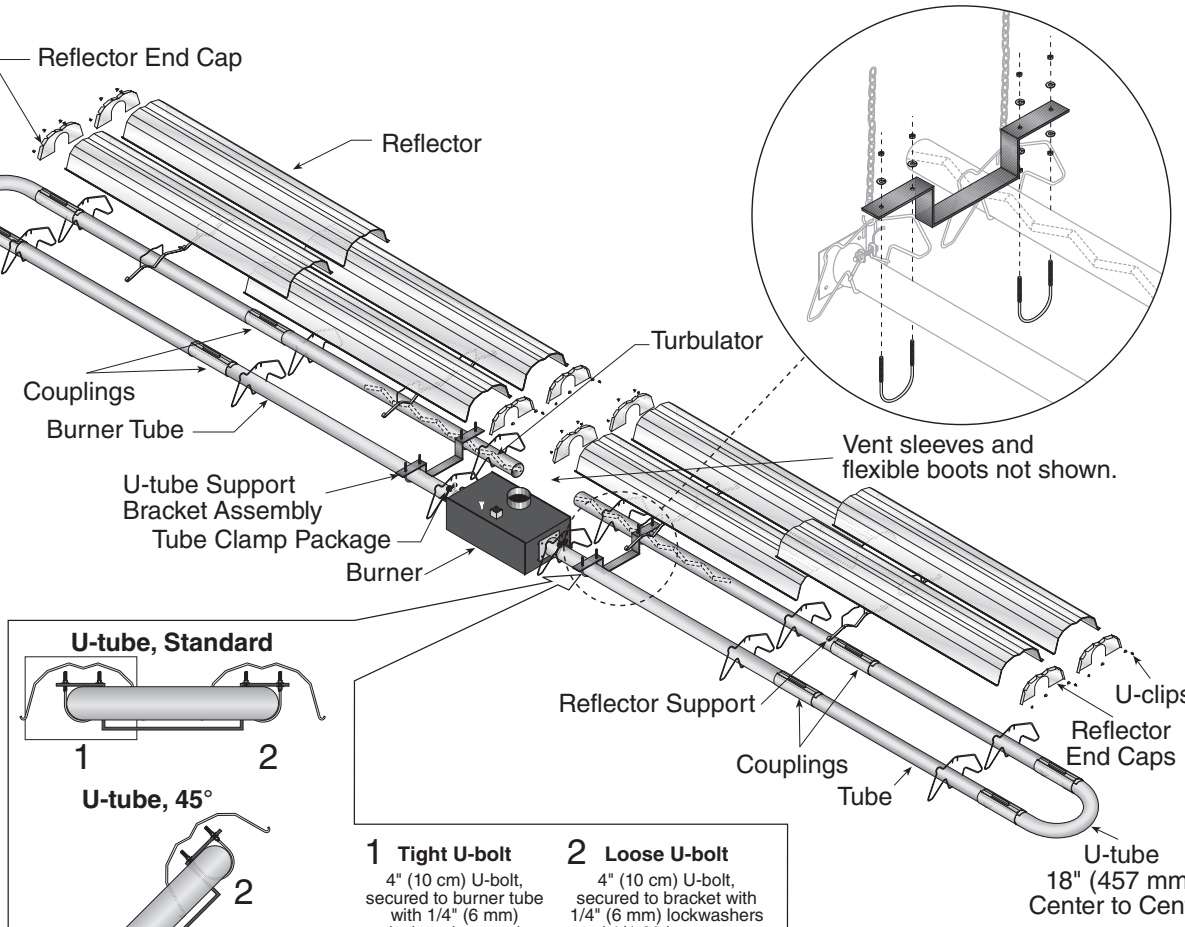
Failure to follow these instructions can result in injury.

8.1 U-Tube Configuration

The heaters are approved for optional U-Tube configurations. This installation requires 1 or 2 U-Tube packages depending on configuration desired. Shown below is an example of a typical 80' (24 m) U-Tube configuration. The U-Tube may be installed in either a standard horizontal position or in an opposite 45° position as shown below. When designing a U-Tube configuration, the following additional rules must be adhered to:

- A minimum of 10' (3 m) on TF-120/160 and a minimum of 15' (4.5 m) on TF-200/250/300/ 350/380 is required between the burner and the U-Tube.
- The correct turbulator (*See Page 22, Step 7.5*) must be installed in the last standard section of tube.
- The burner must never be operated in a tilted position.
- When installed in a full 45° position, the burner must be installed on the lower side.
- The heater must be properly supported at all locations. *See Page 27, Figure 19*.

FIGURE 18: U-Tube Heater Assembly Overview



Description	Part Number
U-Tube Package	**03011000**
180° U-Tube	01335901
Tube and Reflector Hanger	03090100
Coupling	01312700
Reflector End Cap (2)	02750800
U-Tube Support Bracket	03020501
4" (10 cm) U-Bolts (2)	90912500
Reflector Support Set	**03050010**
S-Hook	91907302
Hex Nut	92113000
Lock Washer	96411500

FIGURE 19: U-Tube Heater Layout Overview

U-tube layouts showing one side. Use same measurements for the other side.

LEGEND

- Burner
- Reflector
- Tube 10' (3 m)
- Tube 5' (1.5 m)**
- Tube/Reflector Hanger
- Coupling Assembly
- U-tube

a = 14" (36 cm)
reflector width (not shown)

b = 2" (5 cm)
end cap to burner

c = 2" (5 cm)
end cap to hanger

d = 7'6" (229 cm)
distance first hanger

e = 10' (305 cm)
distance between hangers

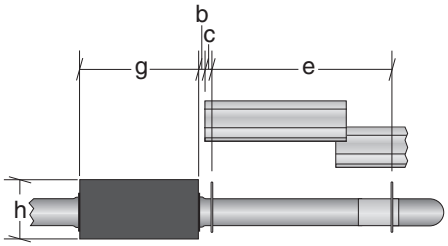
f = 5' (153 cm)
distance between last full tube hanger and half tube hanger

g = 17.5" (44 cm)
burner length

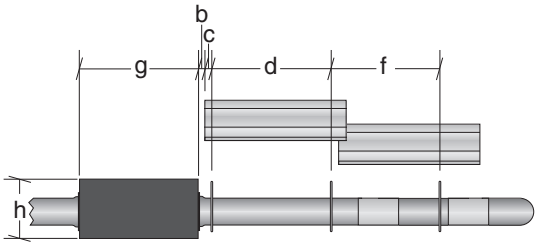
h = 9.5" (24 cm)
burner height

*Requires the last **reflector** before the u-tube to be cut in half for use on both sides.

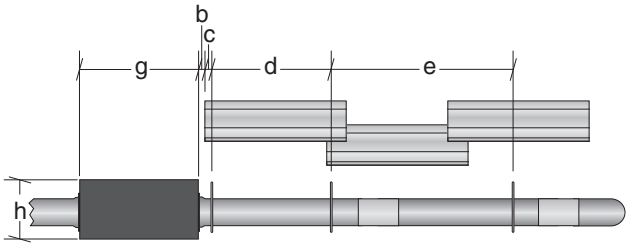
Requires the last **tube before the u-tube to be cut in half for use on both sides.



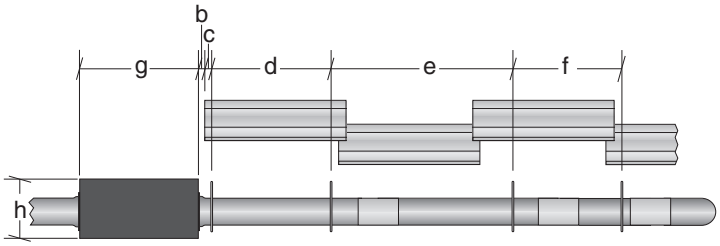
20' (6 m) Tube Length* (Each Side)



30' (9 m) Tube Length**(Each Side)

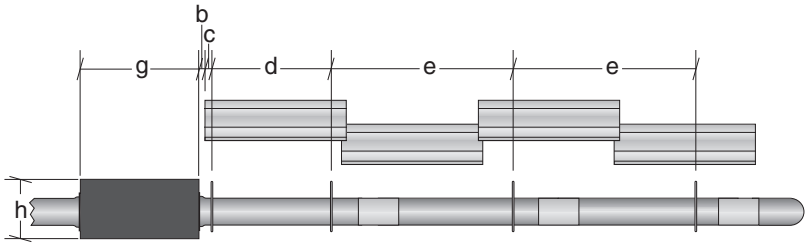


40' (12 m) Tube Length (Each Side)

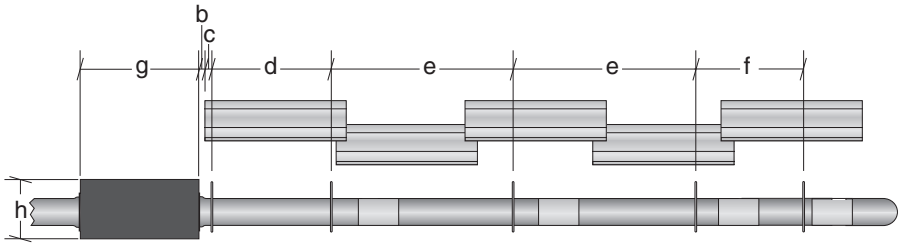


50' (15 m) Tube Length* ** (Each Side)

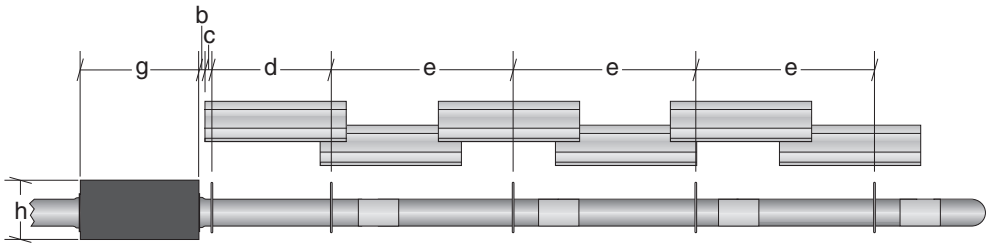
FIGURE 20: U-Tube Heater Layout Overview (Continued)



60' (18 m) Tube Length (Each Side)



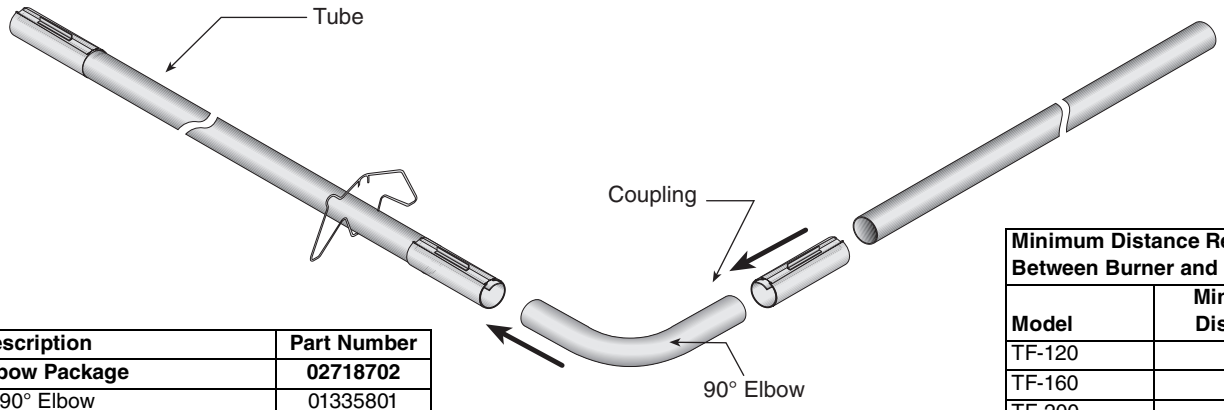
70' (21 m) Tube Length** (Each Side)



80' (24 m) Tube Length** (Each Side)

8.2 Elbow Package Configuration

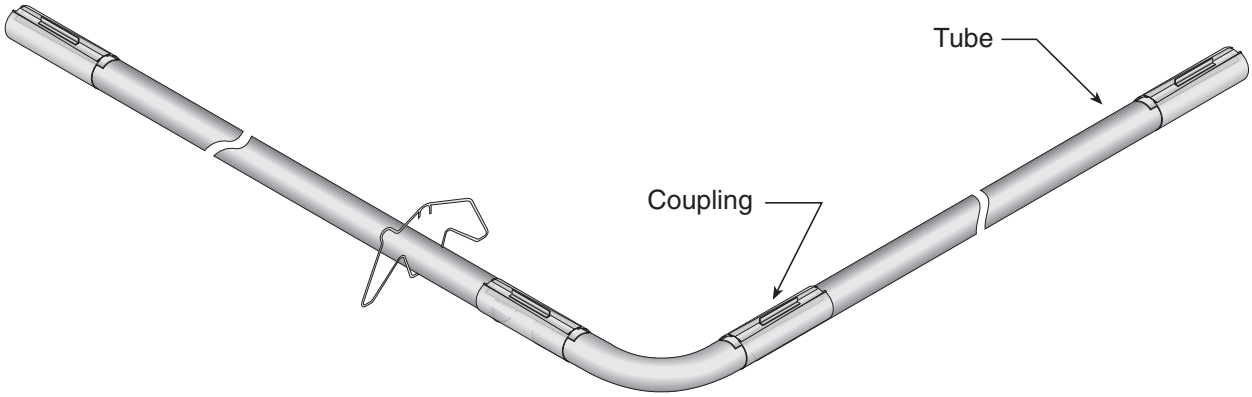
Step 8.2.1 Elbow Installation



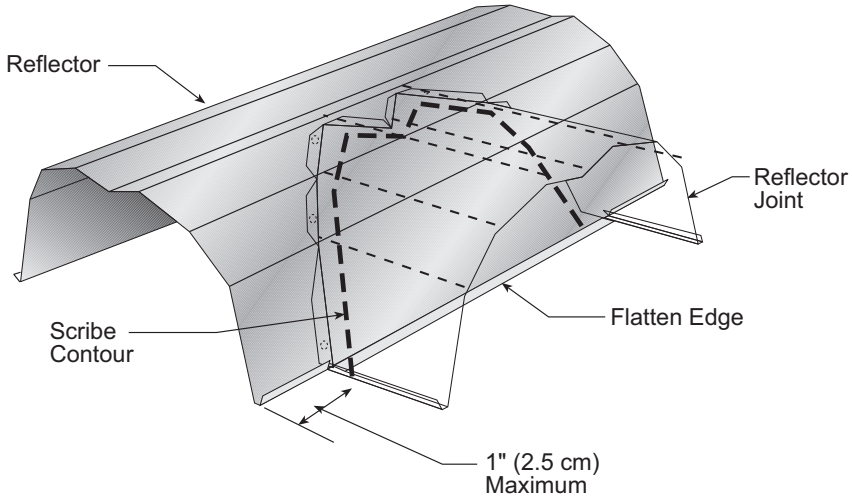
Description	Part Number
Elbow Package	**02718702**
90° Elbow	01335801
Coupling	01312700
Reflector End Cap	02750800
Reflector Joint Piece	02750900
U-Clip Package	**91107720**

Minimum Distance Required Between Burner and Elbow	
Model	**Minimum Distance**
TF-120	10'
TF-160	10'
TF-200	15'
TF-250	15'
TF-300	15'
TF-350	15'
TF-380	15'

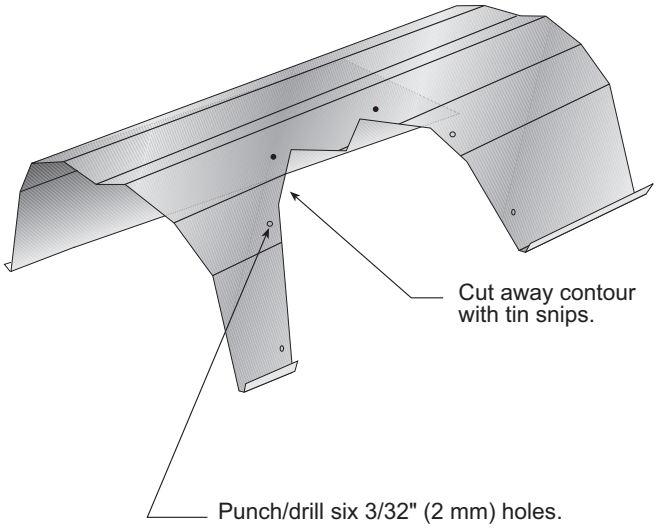
Step 8.2.2 Elbow Installation



Step 8.2.3 Reflector Joint Installation



Step 8.2.4 Reflector Joint Installation



Step 8.2.5 Reflector Joint Detail

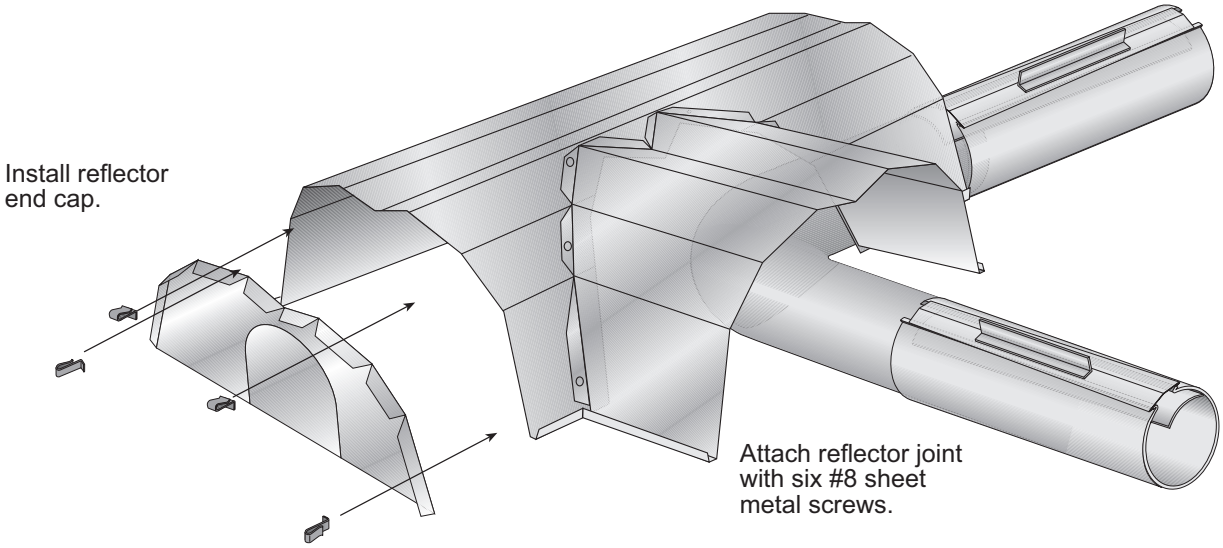
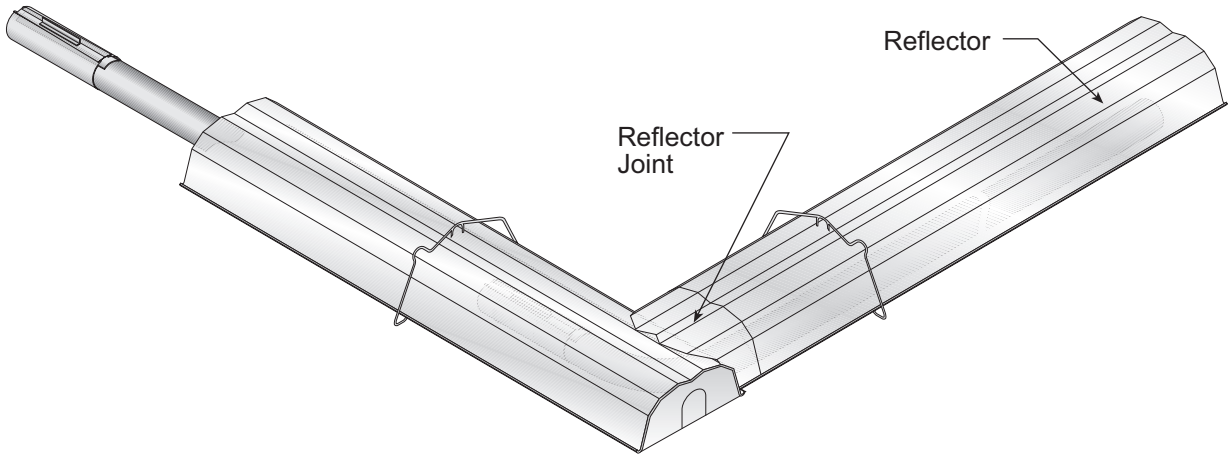
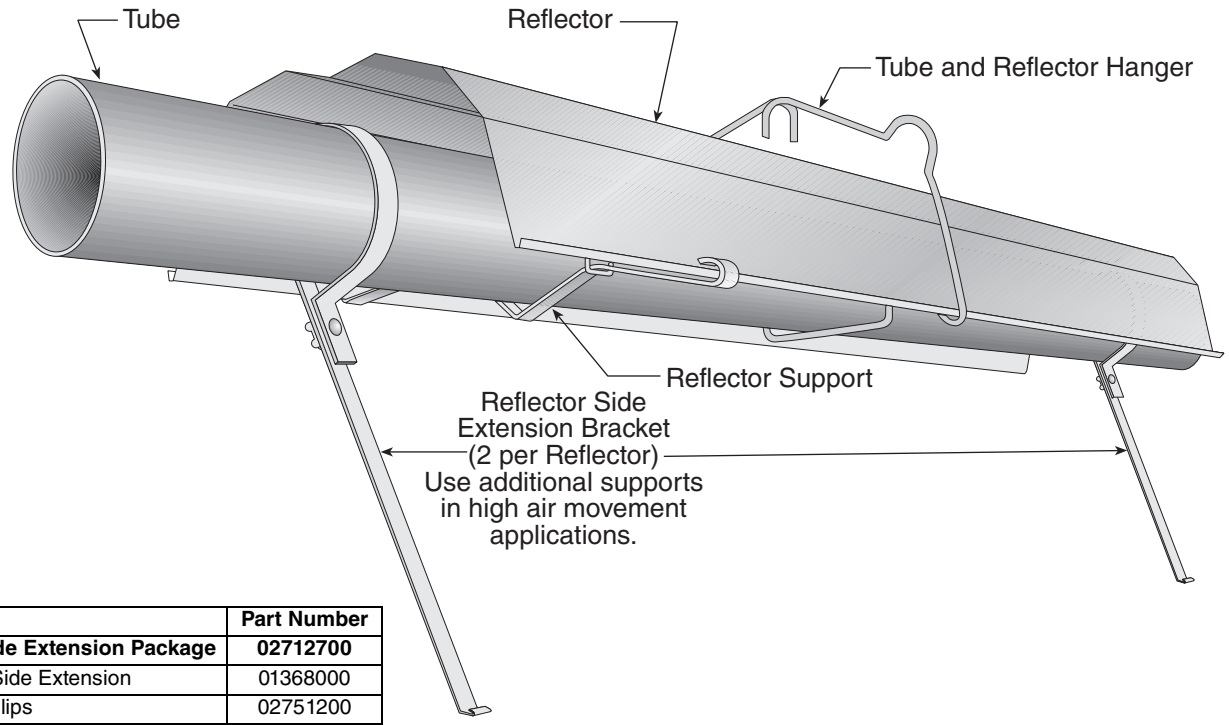


FIGURE 21: Reflector Joint Detail



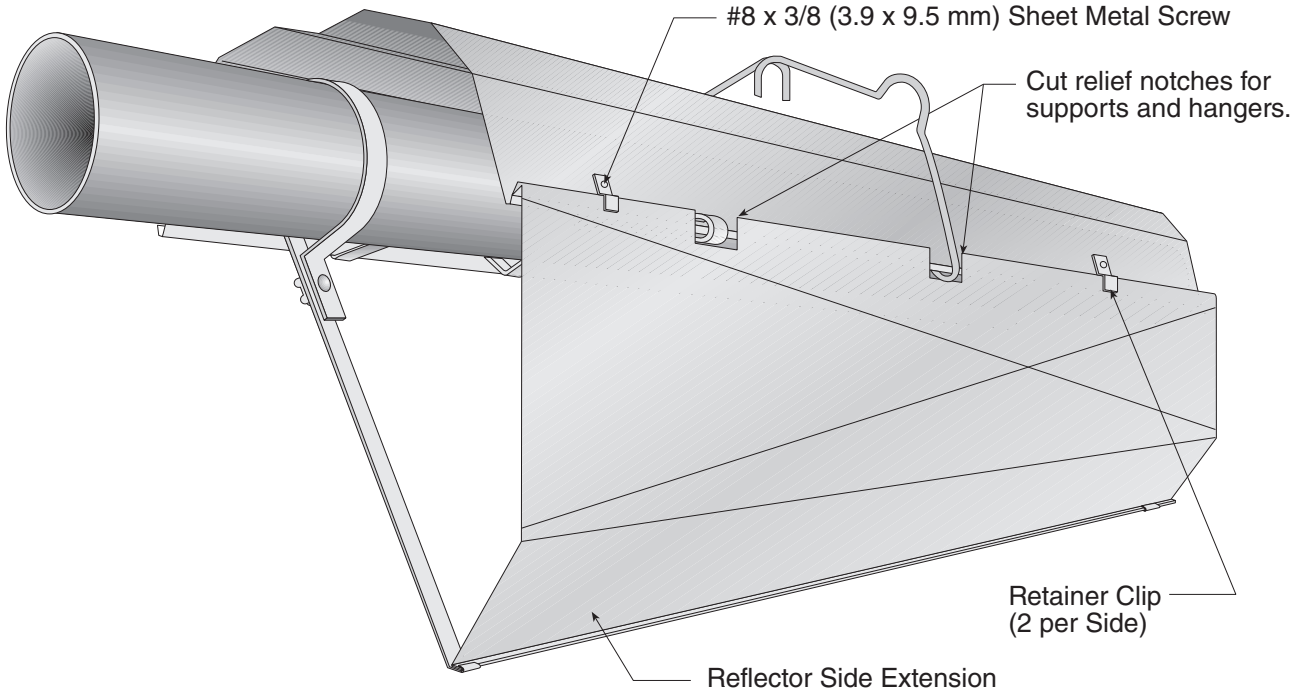
8.3 Reflector Side Extension

Step 8.3.1 Bracket Installation



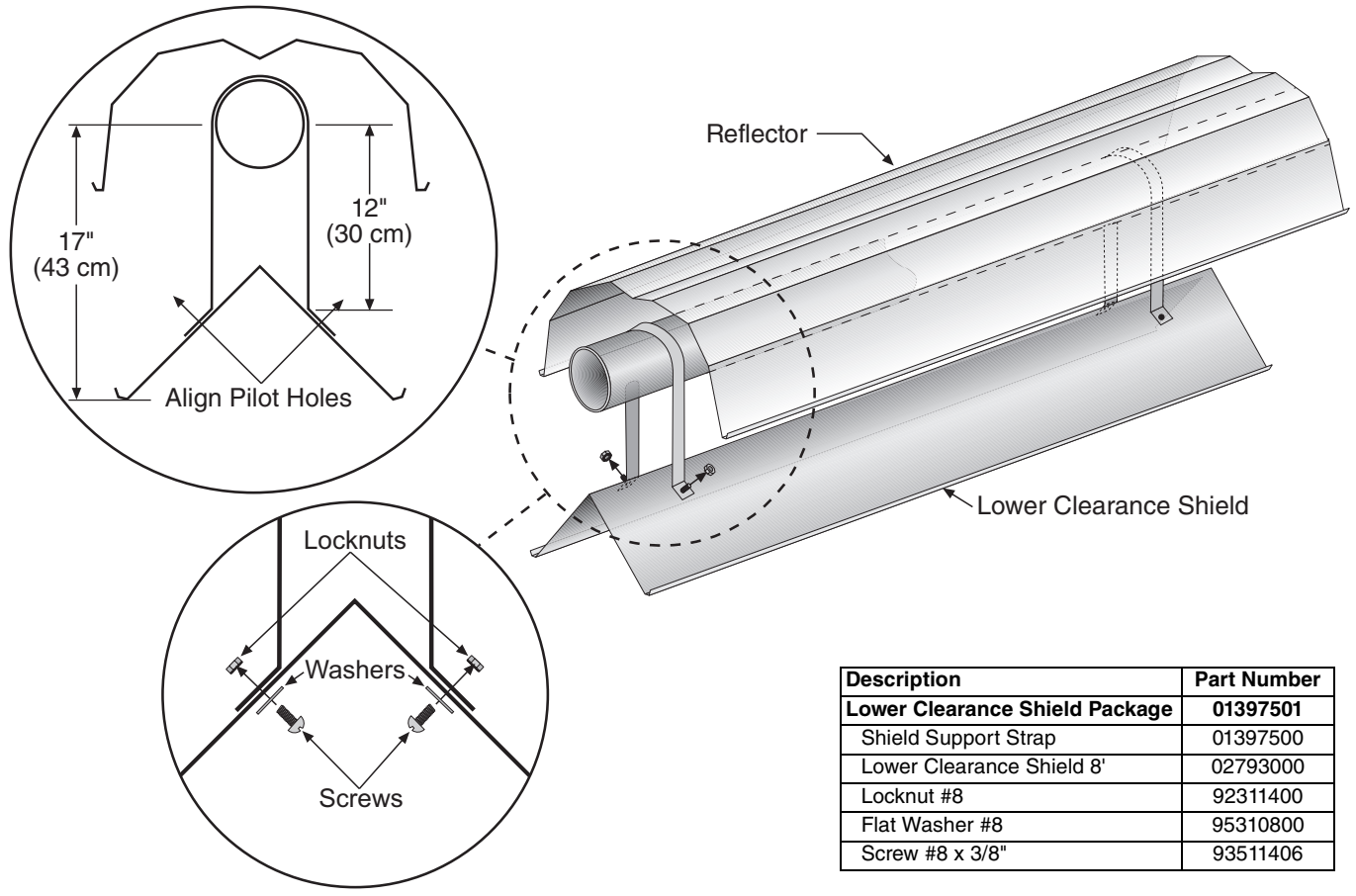
Description	Part Number
Reflector Side Extension Package	**02712700**
Reflector Side Extension	01368000
Retainer Clips	02751200
Sheet Metal Screws	94118106
Order Separately	
Reflector Side Extension	01329910

Step 8.3.2 Side Reflector Installation


#8 x 3/8 (3.9 x 9.5 mm) Sheet Metal Screw
Cut relief notches for
supports and hangers.
Retainer Clip
(2 per Side)
Reflector Side Extension

8.4 Lower Clearance Shield Installation

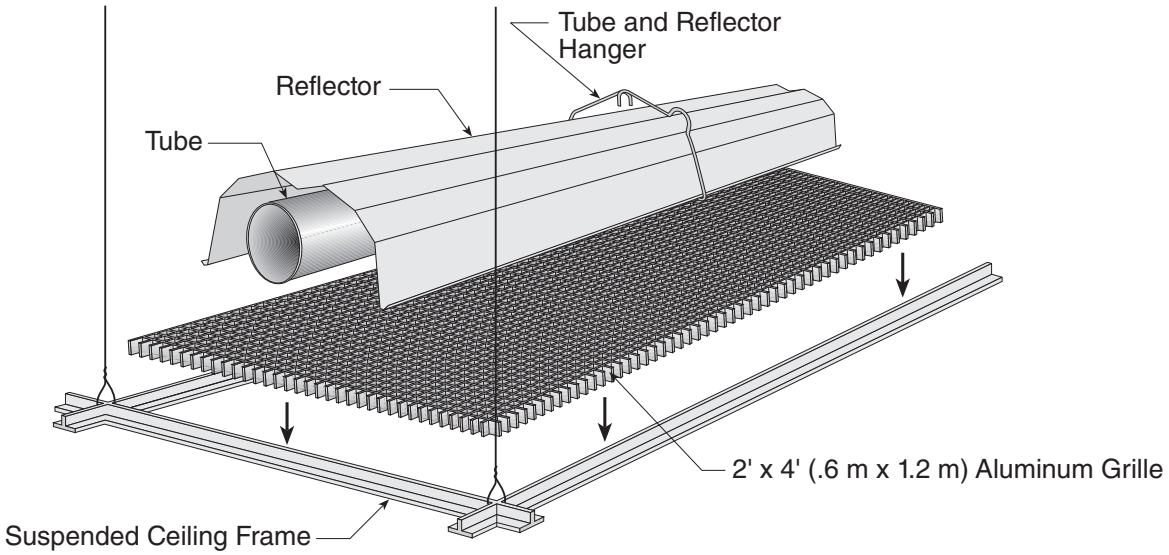
Step 8.4.1 Shield Support Strap Assembly



Description	Part Number
Lower Clearance Shield Package	**01397501**
Shield Support Strap	01397500
Lower Clearance Shield 8'	02793000
Locknut #8	92311400
Flat Washer #8	95310800
Screw #8 x 3/8"	93511406

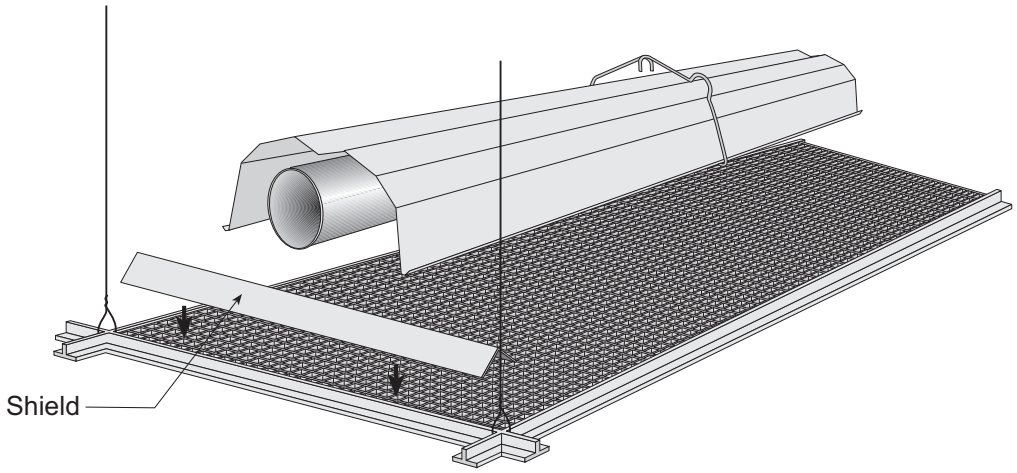
8.5 Two-Foot Decorative Grille Installation

Step 8.5.1 Grille Installation



Description	Part Number
Aluminium Grille 2' x 4'	91407000

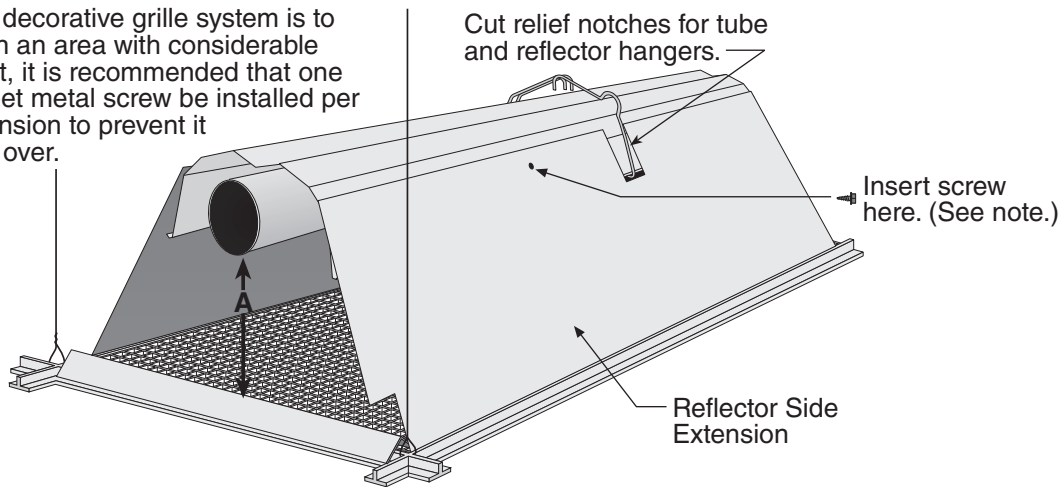
Step 8.5.2 Frame Shield Installation



Description	Part Number
Deco Grille Shield	01365900

Step 8.5.3 Reflector Side Extension Installation for Decorative Grilles

NOTE: If the decorative grille system is to be installed in an area with considerable air movement, it is recommended that one #8 x 3/8" sheet metal screw be installed per reflector extension to prevent it from blowing over.

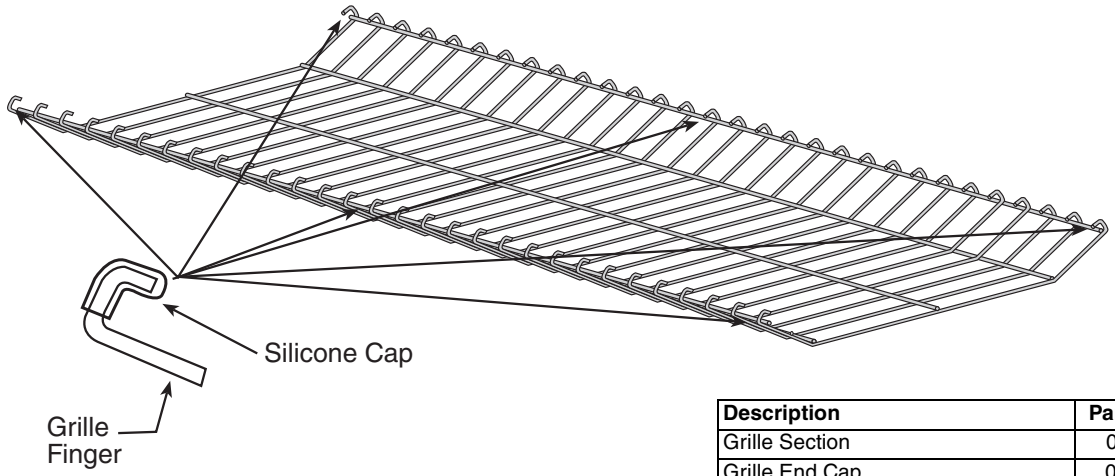


Distance "A"		Extension	
Minimum	Maximum	Part No.	Width
2" (4 cm)	6" (15 cm)	01370408	8" (20 cm)
6" (15 cm)	10" (26 cm)	01370412	12" (30 cm)
10" (26 cm)	14" (37 cm)	01370416	16" (40 cm)

Description	Part Number
Reflector Side Extension	01370412

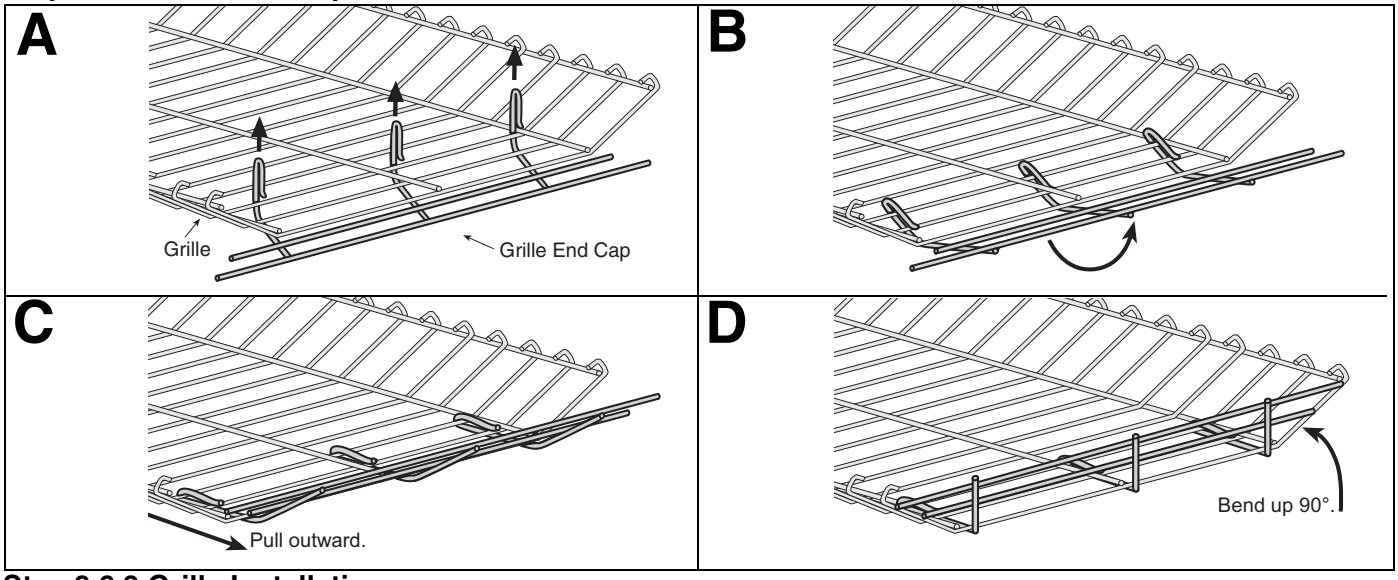
8.6 Protective Grille Installation

Step 8.6.1 Silicone Cap Installation

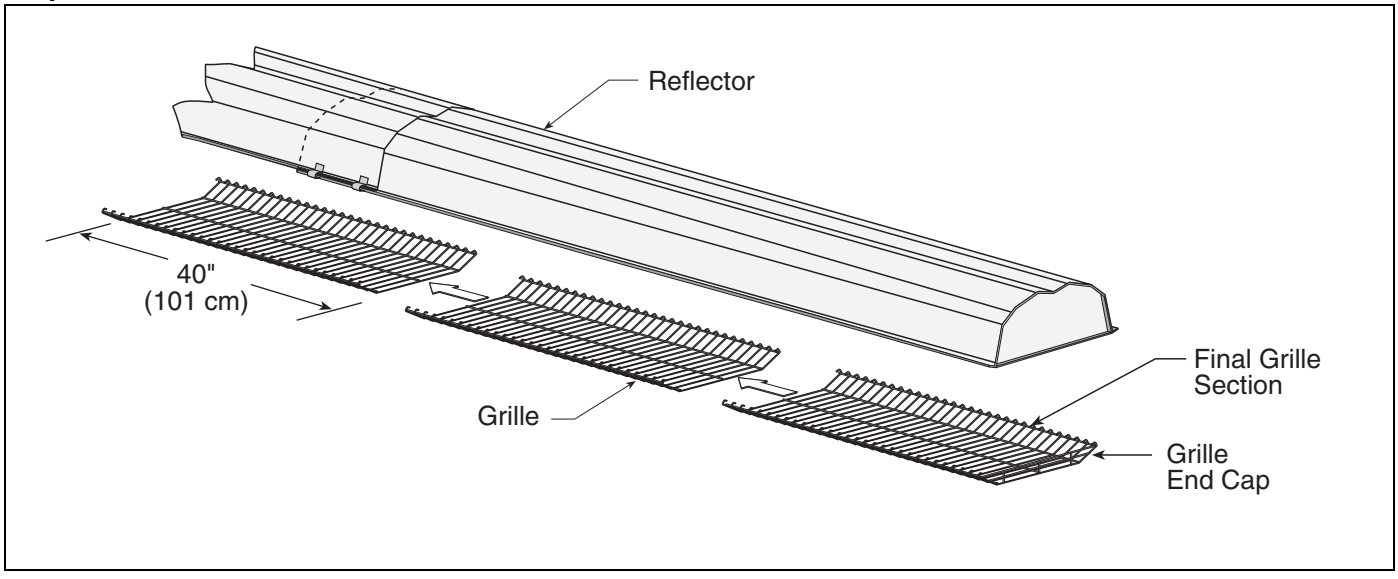


Description	Part Number
Grille Section	08050001
Grille End Cap	08050002
Silicone Cap	91915951-6P

Step 8.6.2 Grille End Cap Installation



Step 8.6.3 Grille Installation



SECTION 9: VENTING

⚠WARNING

Carbon Monoxide Hazard

Multiburner systems are not approved for unvented use and must be vented outdoors.

Vented heaters must be installed according to the installation manual.

Failure to follow these instructions can result in death or injury.

⚠WARNING

Cut/Pinch Hazard

Wear protective gear during installation, operation and service.

Edges are sharp.

Failure to follow these instructions can result in injury.

9.1 Venting Requirements

This heater must be vented in accordance with the rules contained in this manual and with the following national codes and any state, provincial or local codes which may apply:

United States: Refer to National Fuel Gas Code NFPA 54/ANSI Z223.1 - latest revision.

Canada: Refer to Natural Gas and Propane Installation Code CSA B149.1 - latest revision.

Any portion of vent pipe passing through a combustible wall or roof must be dual insulated (Type B) vent pipe and have an approved thimble to conform with the above listed codes.

Vent pipe must be sloped downward away from the burner, 1/2" (1 cm) for every 20' (6 m).

Both sides of the TF-Series heater may be individually vented 4" (10 cm) or common vented 6" (15 cm).

The heater may also be installed unvented in certain circumstances according to building ventilation codes. Refer to the above codes for further information. Unvented operation also requires compliance with the clearances to combustibles given *on Page 7, Figure 12*.

The bottom of the vent or air intake terminal shall not be located less than 1' (0.3 m) above grade level.

The vent shall not terminate less than 7' (2.1 m) above grade where located adjacent to public walkways.

Vent terminal must be installed at a height sufficient to prevent blockage by snow and building materials protected from degradation by flue gases.

Vent must be at least 6' (2 m) from the combustion air opening of this unit, or any other appliance. Secure all joints with #8 x 3/8 sheet metal screws. Seal all joints with high temperature silicone sealant. Vent terminal must be beyond any combustible overhang.

9.1.1 United States Requirements

Vent must terminate at least 3' (0.9 m) above any forced air inlet located within 10' (3.1 m).

Vent must terminate at least 4' (1.2 m) below, 4' (1.2 m) horizontally from, or 1' (0.3 m) above any door, operable window, or gravity air inlet into any building.

9.1.2 Canadian Requirements

The vent shall not terminate within 6' (1.8 m) of a mechanical air supply inlet to any building.

The vent shall not terminate within 3' (0.9 m) of a window or door that can be opened in any building, any non-mechanical air supply inlet to any building, or of the combustion air inlet of any other appliance.

9.2 Unvented Operation

Sufficient ventilation must be provided in the amount of 4 cfm per 1000 BTU/hr firing rate (United States); 3 cfm per 1000 BTU/hr firing rate (Canada).

Use of optional outside combustion air is not recommended with unvented heaters.
If exhaust fans are used to supply ventilation air, an interlock switch must be used to prevent the heater from coming on when the fans are off. This may be done using a pressure switch.

⚠WARNING

Combustion by-products contain a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

9.3 Horizontal Venting

In noncombustible walls only, vent terminal (P/N 02537801-1P) may be used.

For 4" (10 cm) vents in either combustible or noncombustible walls, use Tjernlund VH1-4 (P/N 90502100) or equivalent, insulated vent terminal. Follow the manufacturer's instructions for proper installation.

For 6" (15 cm) common vents in either combustible or noncombustible walls, use Tjernlund VH1-6 (P/N 90502101) or equivalent, insulated vent terminal. Follow the manufacturer's instructions for proper installation.

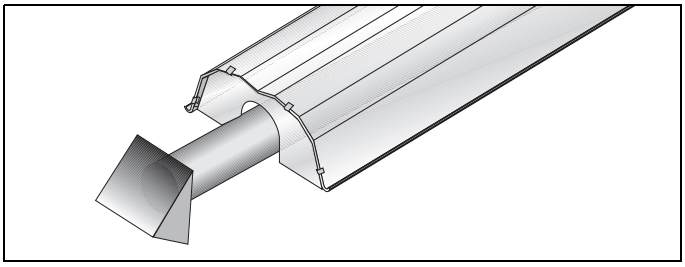
9.4 Vertical Venting

For 4" (10 cm), an approved vent cap (P/N 90502300) must be used.
For 6" (15 cm) common vent, an approved vent cap (P/N 90502302) must be used.
A vent shall not extend less than 2' (0.6m) above the highest point where it passes through a flat roof of a building.

9.5 Unvented Operation Tube Termination

Turndown type vent terminal with a screen must be installed at the exhaust end of the tube. Vent terminal design shall not incorporate backdraft flap.

FIGURE 22: Tube Termination



9.6 Length Requirements

The maximum vent length, where both tubes are vented together is 45’ (13.7 m) of 6" (15 cm) diameter duct. The maximum vent length, where both tubes are vented individually is 45’ (13.7 m) of 4" (11 cm) diameter duct, or 22.5’ (7 m) on each tube.

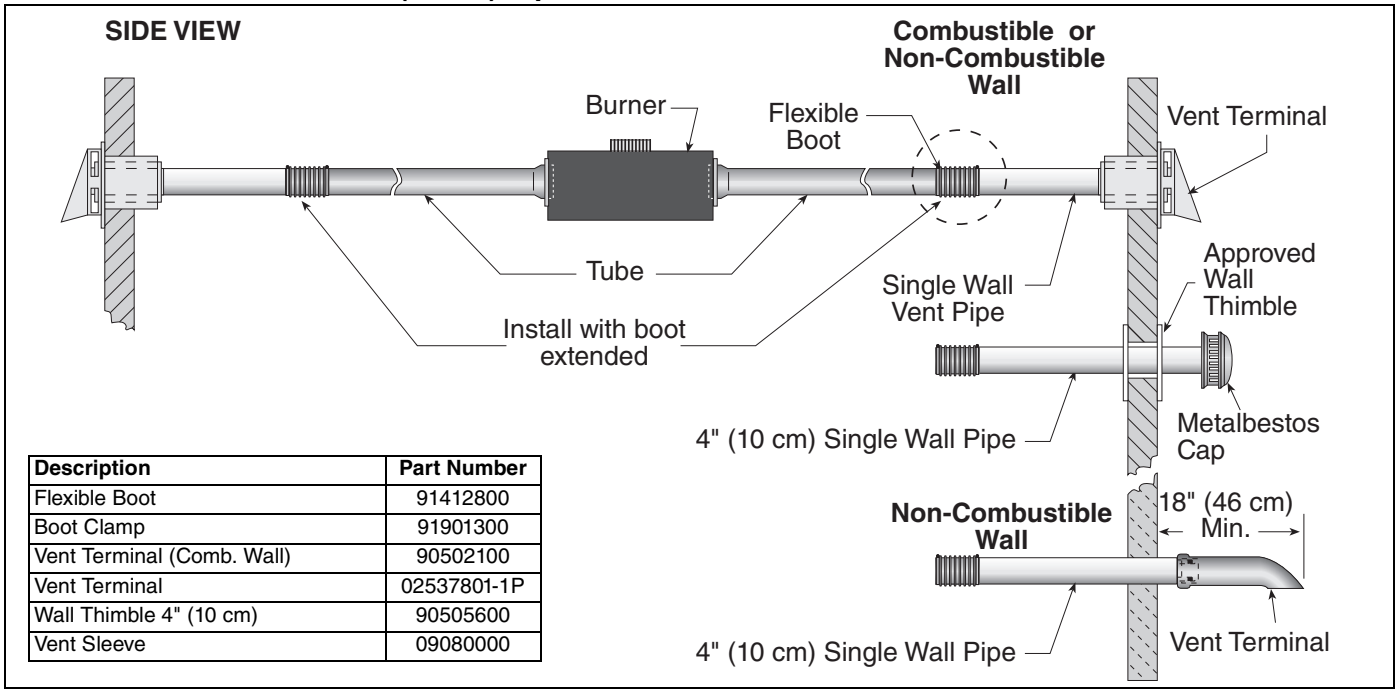
The maximum outside air supply duct length allowed is 45’ (13.7 m) of either 4" (10 cm) or 5" (13 cm) diameter, however the maximum length depends on the venting arrangement used.

The total vent length, plus outside air duct length, plus any extensions to minimum heat exchanger lengths, cannot exceed 65' (19.8 m).

Vent length should be limited to less than 20' (6 m). If using vent lengths greater than 20' (6 m), condensation will form in the vent pipe. Insulation and additional sealing measures (high temperature silicone at all seams) are required. Optional heat exchanger lengths are considered as vent length for length determination.

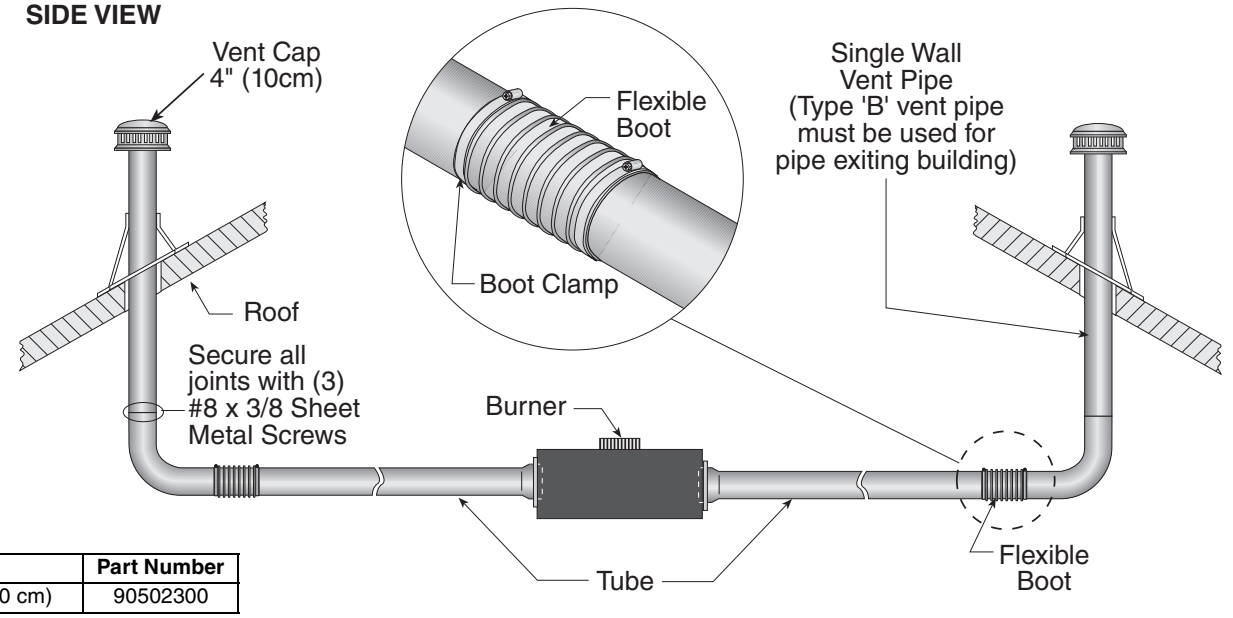
Subtract 15' (4.6 m) of maximum allowed vent or duct length per vent elbow if more than two are used.

9.7 Horizontal Ventilation 4" (10 cm) Pipe



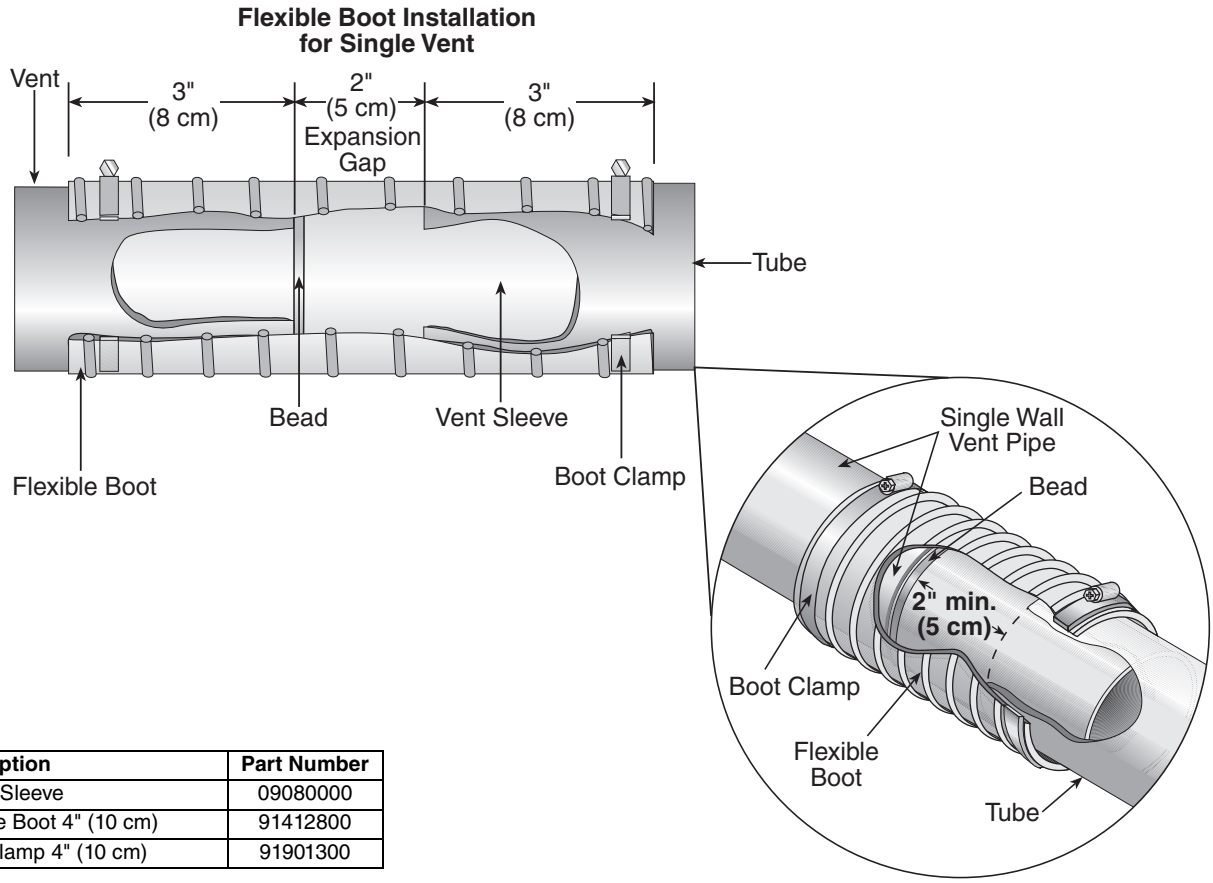
Description	Part Number
Flexible Boot	91412800
Boot Clamp	91901300
Vent Terminal (Comb. Wall)	90502100
Vent Terminal	02537801-1P
Wall Thimble 4" (10 cm)	90505600
Vent Sleeve	09080000

9.8 Vertical Ventilation 4" (10 cm) Pipe



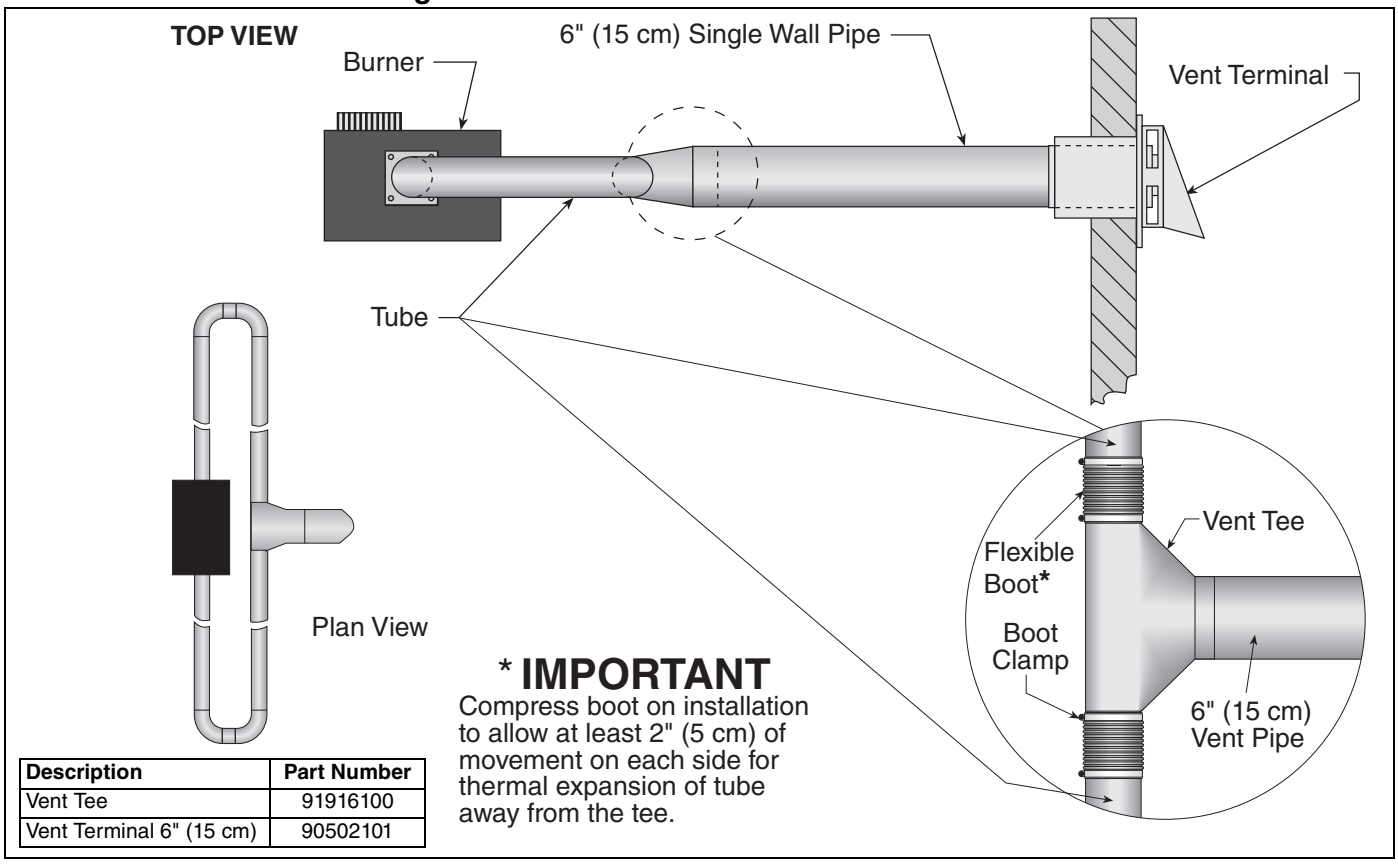
Description	Part Number
Vent Cap 4" (10 cm)	90502300

9.9 Flexible Boot Installation (Single Vent)



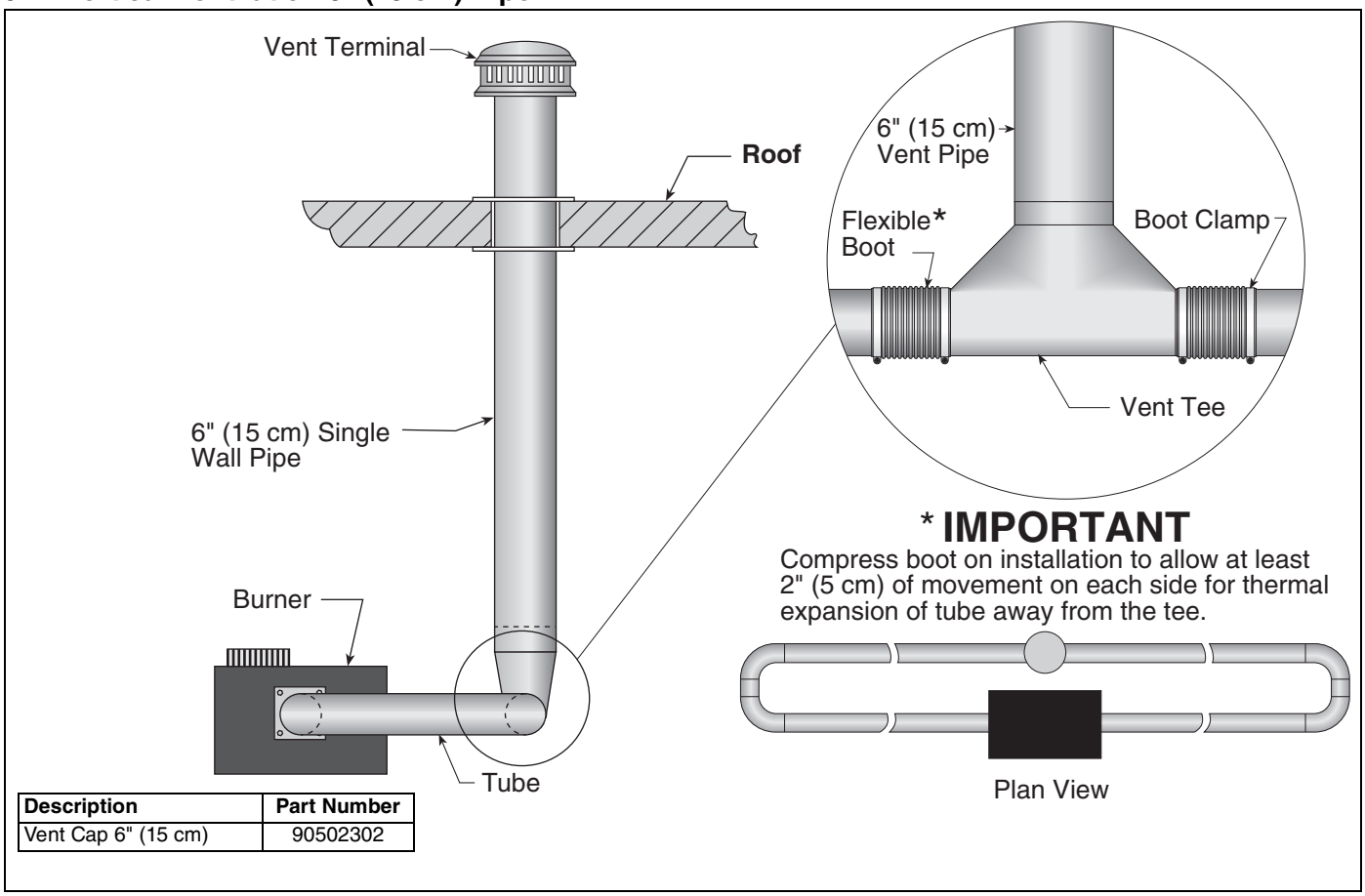
Description	Part Number
Rolled Sleeve	09080000
Flexible Boot 4" (10 cm)	91412800
Boot Clamp 4" (10 cm)	91901300

9.10 Common Sidewall Venting


TOP VIEW
Burner
6" (15 cm) Single Wall Pipe
Vent Terminal
Tube
Plan View
Flexible Boot*
Vent Tee
Boot Clamp
6" (15 cm) Vent Pipe
* IMPORTANT
Compress boot on installation to allow at least 2" (5 cm) of movement on each side for thermal expansion of tube away from the tee.

Description	Part Number
Vent Tee	91916100
Vent Terminal 6" (15 cm)	90502101

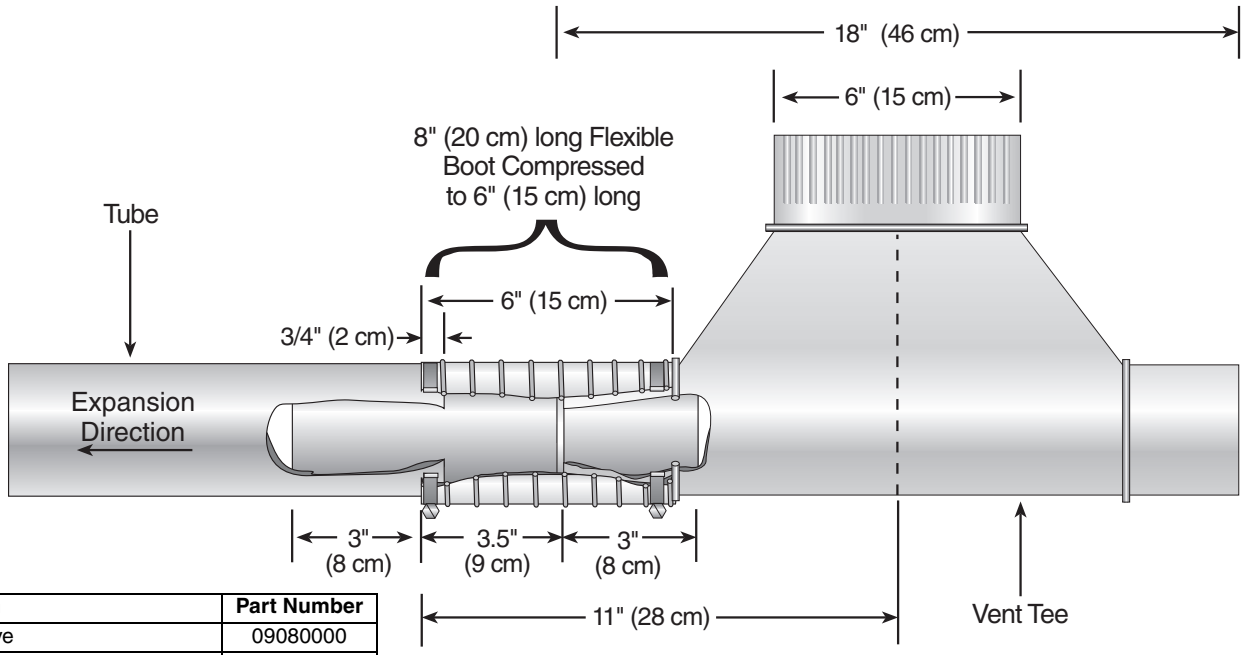
9.11 Vertical Ventilation 6" (15 cm) Pipe


Vent Terminal
Roof
6" (15 cm) Single Wall Pipe
Burner
Tube
6" (15 cm) Vent Pipe
Flexible Boot*
Boot Clamp
Vent Tee
* IMPORTANT
Compress boot on installation to allow at least 2" (5 cm) of movement on each side for thermal expansion of tube away from the tee.
Plan View

Description	Part Number
Vent Cap 6" (15 cm)	90502302

9.12 Flexible Boot Installation (Common Vent)

Rolled Sleeve Installation for Common Vent



Description	Part Number
Rolled Sleeve	09080000
Flexible Boot 4" (10 cm)	91412800
Boot Clamp 4" (10 cm)	91901300
Vent Tee - 4" Dia. x 4" Dia. x 6" Dia.	91916100

9.13 Outside Combustion Air Supply

IMPORTANT: If the building has a slight negative pressure or corrosive contaminants, such as halogenated hydrocarbons, are present in the air, an outside combustion air supply to the heater is required. Seal all combustion air pipe joints.

For TF-120 4" (10 cm) single wall pipe or for TF-160/200/250/300/350/380 5" (13 cm) single wall pipe, PVC pipe, aluminum flex duct, or equivalent may be used for outside air supply.

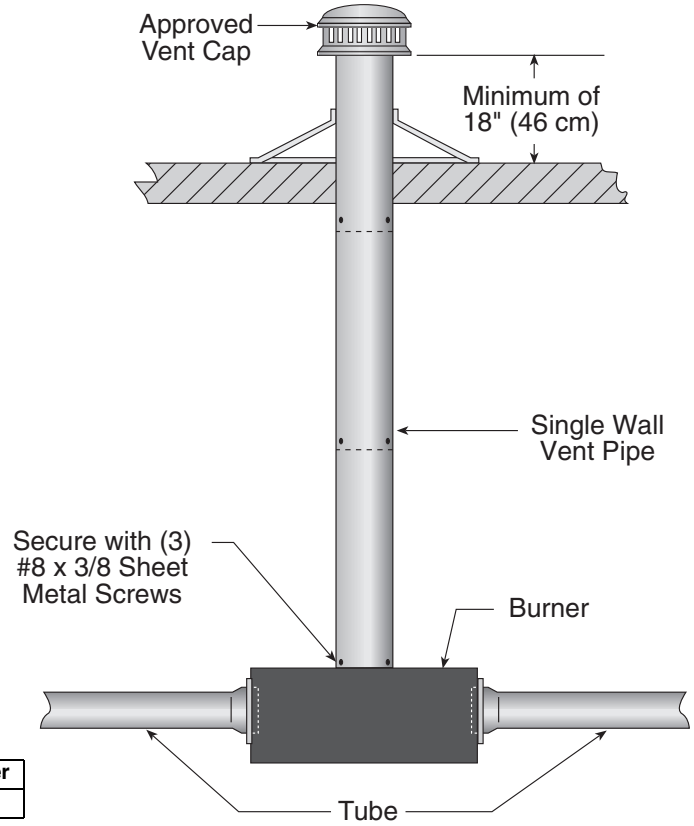
Use of optional outside combustion air is not recommended with unvented heaters.

The air supply duct may have to be insulated to prevent condensation on the outer surface. The outside air terminal must not be more than 1' (31 cm) above the vent terminal.

9.13.1 Length Requirements

Follow the constraints listed *on Page 36, Section 9.6*.

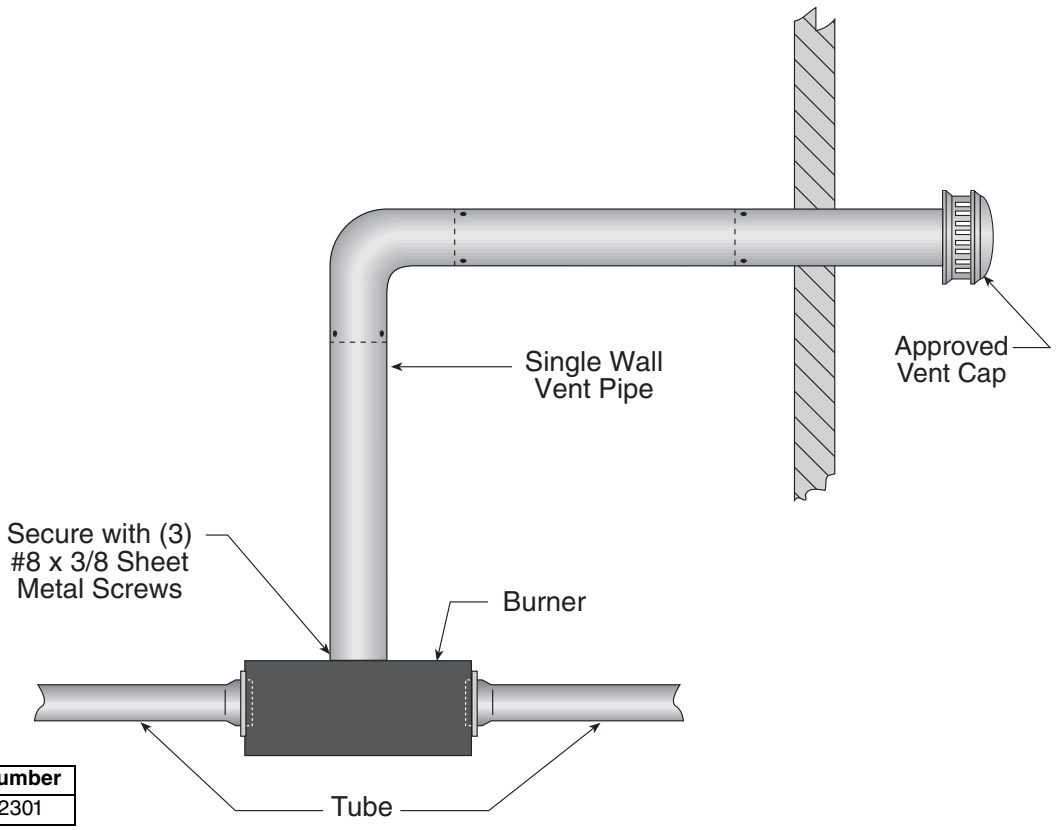
9.13.2 Vertical Outside Air Supply



Suggestion: Wrap pipe with insulation to prevent condensation from forming on outside of pipe.

Description	Part Number
Vent Cap 5" (13 cm)	90502301

9.13.3 Horizontal Outside Air Supply



Description	Part Number
Vent Cap 5" (13 cm)	90502301

SECTION 10: GAS PIPING

⚠ WARNING

Fire Hazard

Tighten gas hose fittings to connect gas supply according to Figure 23.

Gas hose can crack when twisted.

Gas hose moves during normal operation.

Use only 36" (91 cm) long connector of 3/4" nominal ID.

Connector supplied with heater for U.S. models (not with Canadian models).

Failure to follow these instructions can result in death, injury or property damage.

⚠ WARNING

Explosion Hazard

Leak test all components of gas piping before operation.

Gas can leak if piping is not installed properly.

Do not high pressure test gas piping with equipment connected.

Failure to follow these instructions can result in death, injury or property damage.

Install the gas hose as shown *on Page 43, Figure 23*. The gas hose accommodates expansion of the heating system and allows for easy installation and service of the burner. A 90° pipe elbow (not supplied) must be installed into the gas valve to ensure proper orientation of the flex gas connector. Before connecting the burners to the supply system, verify that all high pressure testing of the gas piping has been completed.

There is an expansion of the tube with each firing cycle, this will cause the burner to move with respect to the gas line. This can cause a gas leak resulting in an unsafe condition if the gas connection is not made in strict accordance with *Figure 23 on Page 43*.

Meter and service must be large enough to handle all the burners being installed plus any other connected load. The gas line which feeds the system must be large enough to supply the required gas with a maximum pressure drop of 1/2" w.c. When gas piping is not included in the layout drawing, the local gas supplier will usually help in planning the gas piping.

Gas lines must meet applicable codes:

United States: The Flexible Stainless Steel Gas Hose (US models) supplied with the heater is certified per the Standard for Connectors for Gas Appliances, ANSI Z21.24/CSA 6.10 - latest revision.

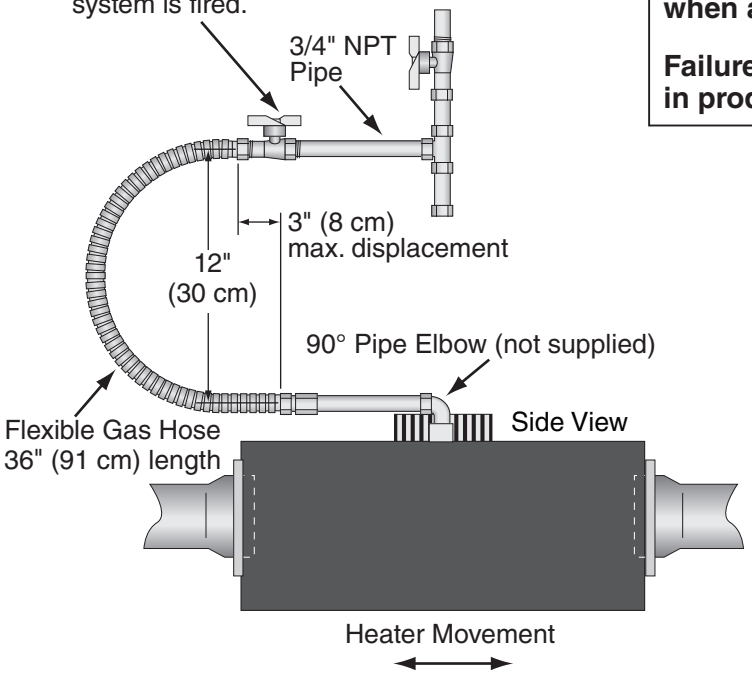
Canada: The Rubber Type 1 Gas Hose (Canadian models) optional with the heater is certified as being in compliance with the Standard for Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas, CAN/CGA 8.1 - Latest revision.

- **Check the pipe and tubing ends for leaks before placing heating equipment into service. When checking for gas leaks, use a soap and water solution; never use an open flame.**

FIGURE 23: Gas Connection with Flexible Gas Hose

CORRECT POSITIONS

Shut-Off Valve (included with gas hose) must be parallel to burner gas inlet. The 3" (8 cm) displacement shown is for the cold condition. This displacement may reduce when the system is fired.

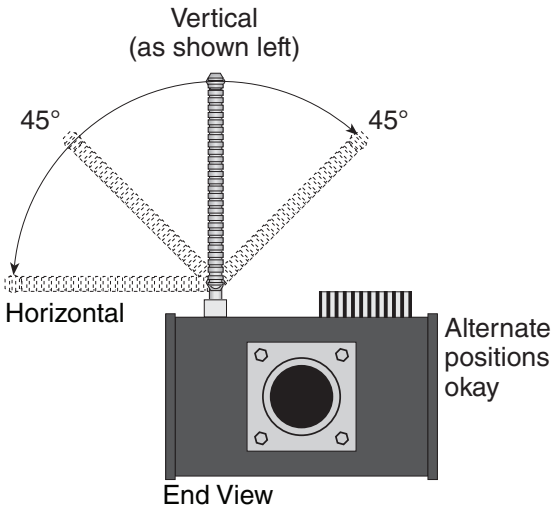


⚠ CAUTION

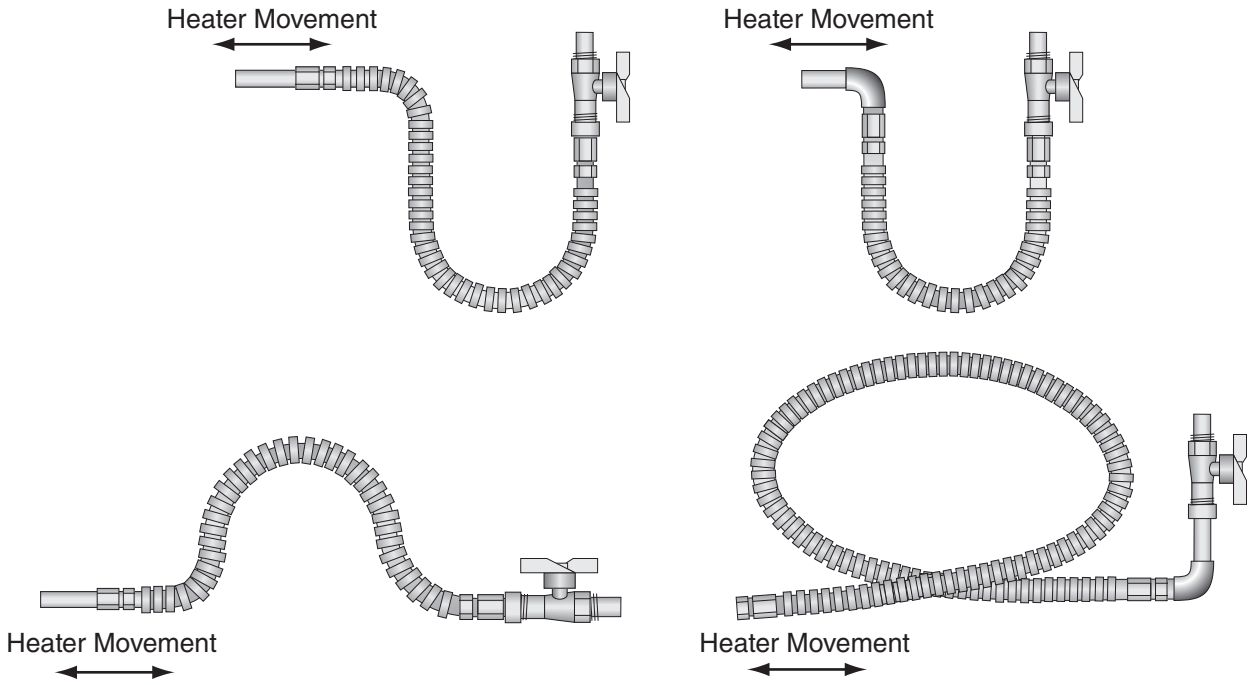
Product Damage Hazard

Hold gas nipple securely with pipe wrench when attaching gas hose.

Failure to follow these instructions can result in product damage.



INCORRECT POSITIONS (WRONG INSTALLATION)



Description	Part Number
3/4" Flexible Stainless Steel Gas Hose (US Models)	91412204
3/4" Rubber Type 1 Gas Hose (Canadian Models)	91412207

SECTION 11: WIRING

⚠ DANGER

Electrical Shock Hazard

Disconnect electric before service or maintenance.

Heater must be connected to a properly grounded electrical source.

Failure to follow these instructions can result in death or electrical shock.

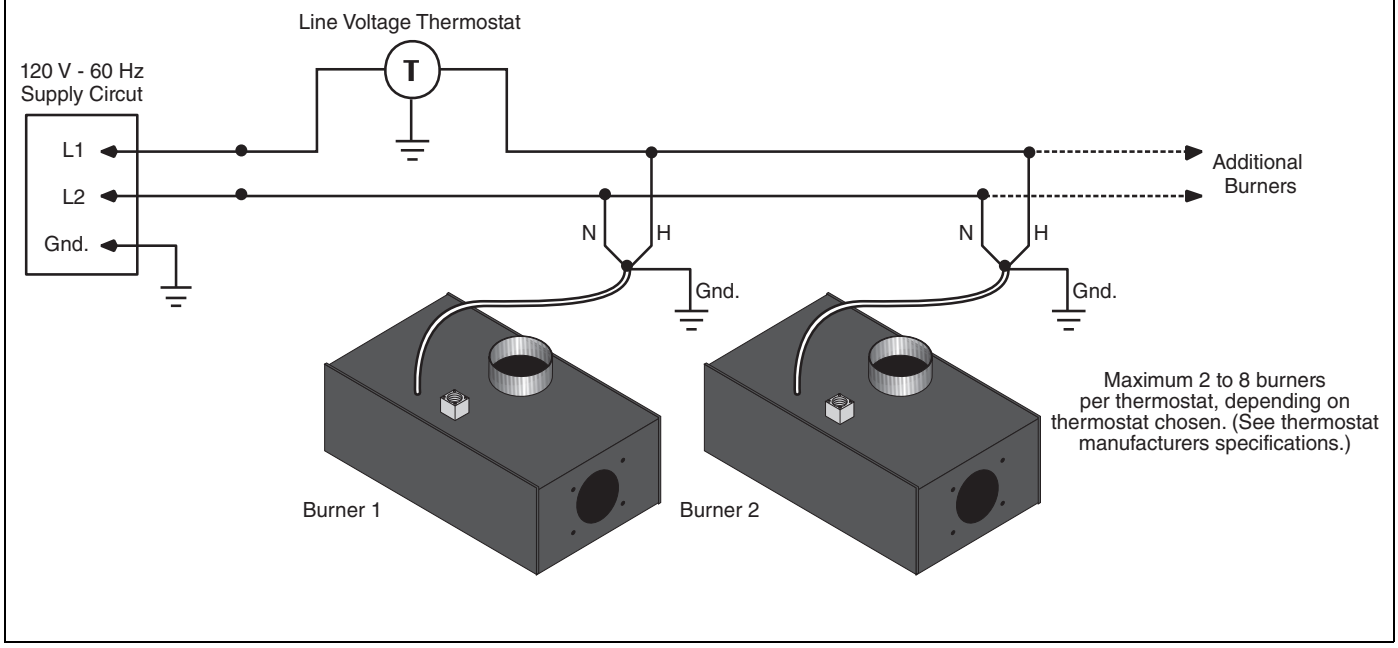
Heaters can be controlled using several methods. Normally thermostats are used to control the heaters but they can also be controlled by an Energy Management System. *Section 11.1* below illustrates the connection for heaters controlled by a line voltage thermostat.

To control multiple heaters on one low voltage thermostat, *See Page 45, Section 11.2*.

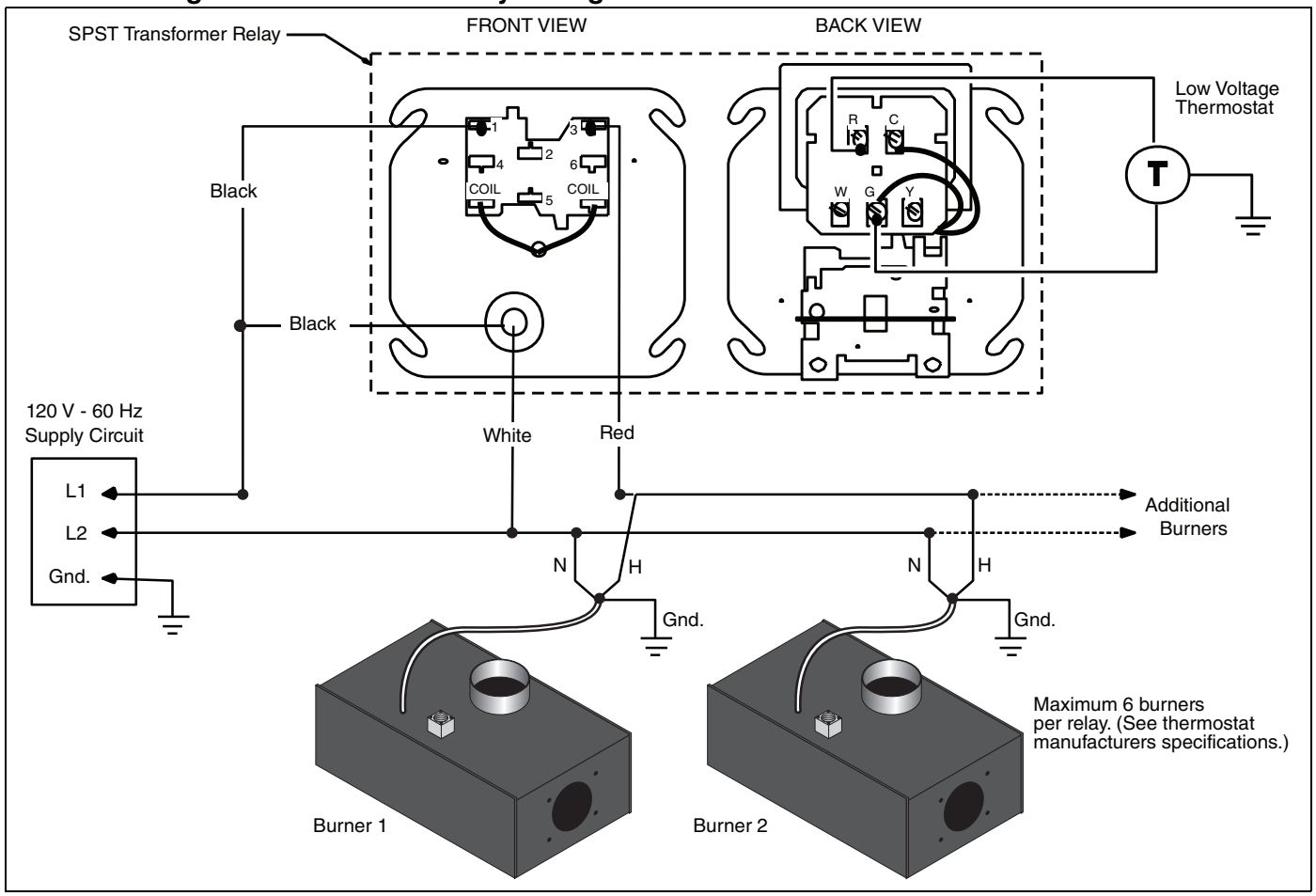
Heaters must be grounded in accordance with applicable codes: United States: refer to National Electrical Code® NFPA 70 - latest revision; Canada: refer to Canadian Electrical Code CSA C22.1 Part I - latest revision.

If any of the original internal wiring must be replaced, it must be replaced with wiring materials having a temperature rating of at least 105° C and 600 V.

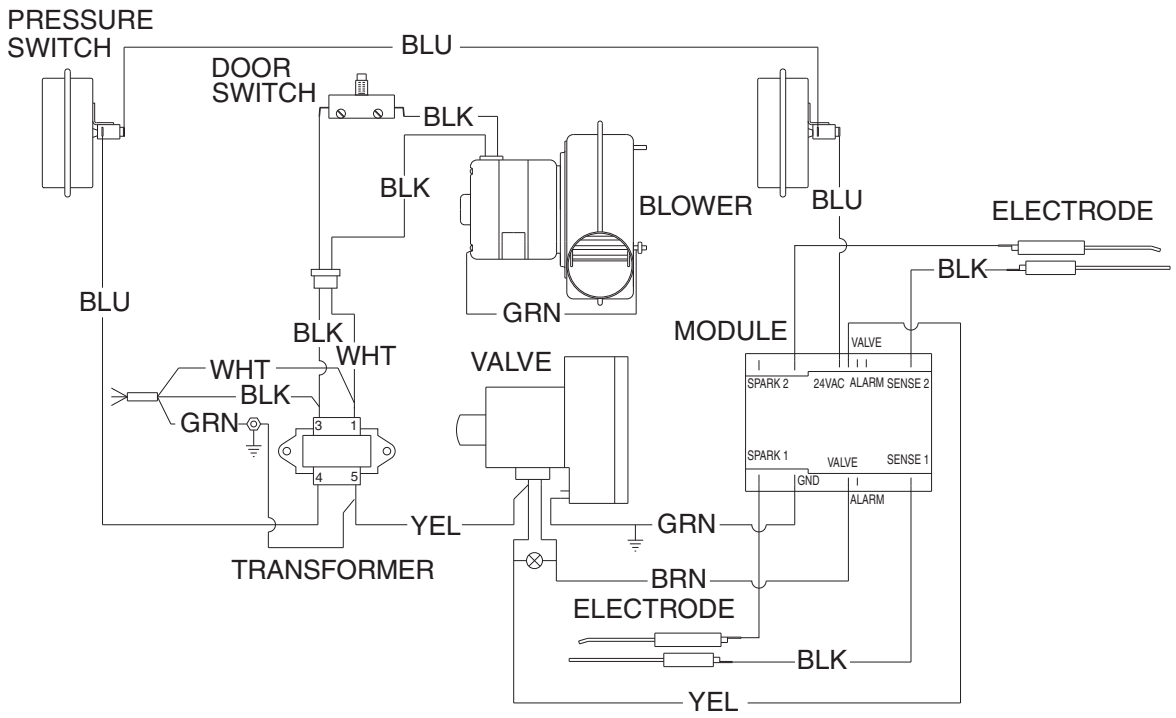
11.1 Line Voltage Thermostat Wiring



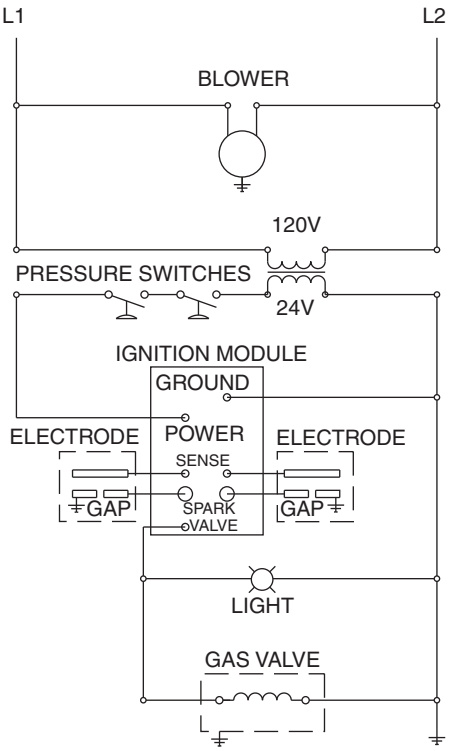
11.2 Low Voltage Thermostat and Relay Wiring



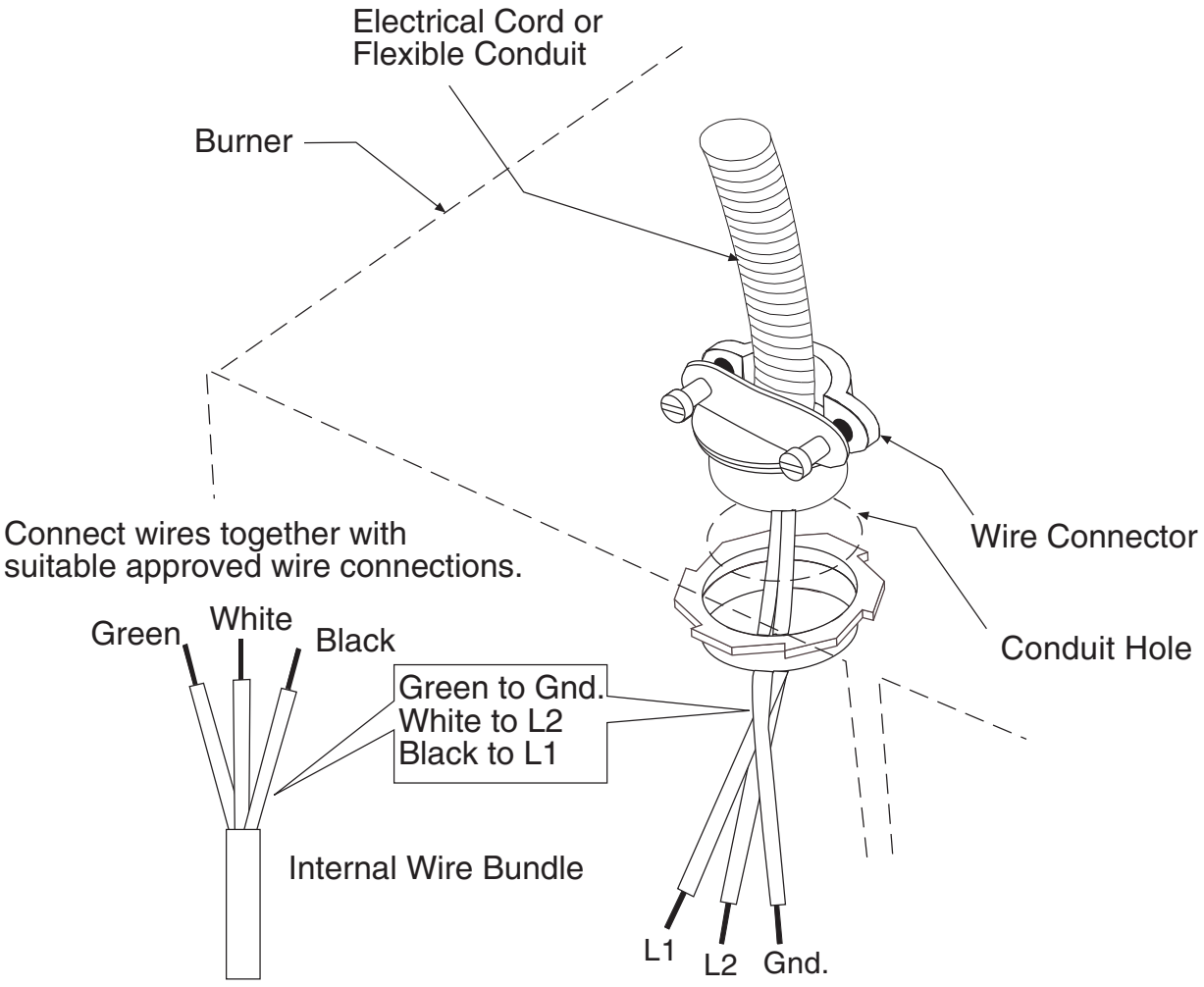
11.3 Internal Wiring



11.4 Ladder Diagram



11.5 Electrical Connection to the Burner



SECTION 12: OPERATION AND MAINTENANCE

⚠ DANGER	⚠ WARNING		
Electrical Shock Hazard **Disconnect electric before service or maintenance.** **More than one disconnect switch may be required to disconnect electric from heater.** **Heater must be connected to a properly grounded electrical source.**	**Explosion Hazard** **Turn off gas supply to heater before service or maintenance.**	**Burn Hazard** **Allow heater to cool before service or maintenance.** **Tubing may still be hot after operation.**	**Cut/Pinch Hazard** **Wear protective gear during installation, operation and service.** **Edges are sharp.**
Failure to follow these instructions can result in death, electric shock, injury or property damage.			

The heater is equipped with a dual direct spark ignition system.

12.1 Sequence of Operation

1. Turn the thermostat up, the blower motor will energize.
2. When the motor approaches nominal running RPM, the pressure switches will close and activate the ignition module.
3. After a 45 second purge period, the ignition module then opens the gas valve and energizes both spark igniters. The light will be illuminated at any time the gas valve is energized.
4. When both flames are established, the sparking sequence ceases.
5. If both flames are not established during the ignition sequence, the ignition module closes the gas valve and purge begins. The module will try two additional times for ignition with purge between trials. If ignition is not established during either of these trials, the module will lock out.
6. After lock out has occurred, the ignition module must be re-set by turning down the thermostat (disconnecting power) for five seconds, and raising it again to the desired temperature.
7. When the thermostat is satisfied, all power to the heater is shut off.

12.2 To Shut Off Heater

Set thermostat to lowest setting.
Turn OFF electric power to heater.
Turn OFF manual gas valve in the heater supply line.

12.3 To Start Heater

Turn gas valve and electric power OFF and wait five minutes for unburned gases to vent from heater.
Turn ON main gas valve.
Turn ON electric power.
Set thermostat to desired temperature. Burner should light automatically.

12.4 Pre-Season Maintenance and Annual Inspection

To ensure your safety and years of trouble-free operation of the heating system, service and annual inspections must be done by a contractor qualified in the installation and service of gas-fired heating equipment.
Turn off gas and electric supplies before performing service or maintenance. Allow heater to cool before servicing.
Before every heating season, a contractor qualified in the installation and service of gas-fired heating

equipment must perform a thorough safety inspection of the heater.

For best performance, the gas, electrical, thermostat connections, tubing, venting, suspensions and overall heater condition should be thoroughly inspected.

NOTE: Gas flow and burner ignition are among the first things that should be inspected. Please *see Page 48, Section 12.5* for suggested items to inspect.

12.5 Maintenance Checklist

Installation Code and Annual Inspections:

All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment.

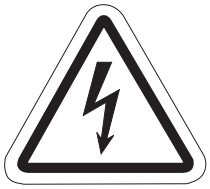
To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

The Vicinity of the Heater	Do not store or use flammable objects, liquids or vapors near the heater. Immediately remove these items if they are present. *See Page 4, Section 3*.
Vehicles and Other Objects	Maintain the clearances to combustibles. Do not hang anything from, or place anything on, the heater. Make sure nothing is lodged underneath the reflector, in between the tubes or in the decorative or protective grilles (included with select models). Immediately remove objects in violation of the clearances to combustibles. *See Page 4, Section 3*.
Reflector	Support reflector with reflector hanger and support strap. Reflector must not touch tube. Make sure there is no dirt, sagging, cracking or distortion. Do not operate if there is sagging, cracking or distortion. Make sure reflectors are correctly overlapped. *See Page 24, Section 7.6.1*. Clean outside surface with a damp cloth.
Vent Pipe	Venting must be intact. Using a flashlight, look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Remove any carbon deposits or scale using a wire brush. *See Page 35, Section 9*.

Outside Air Inlet	Inlet must be intact. Look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Clean and reinstall as required.
Tubes	Make sure there are no cracks. Make sure tubes are connected and suspended securely. *See Page 14, Section 7*. Make sure there is no sagging, bending or distortion. Clean or replace as required.
Gas Line	Check for gas leaks. *See Page 42, Section 10*.
Burner Observation Window	Make sure it is clean and free of cracks or holes. Clean and replace as required.
Blower Scroll, Wheel and Motor	Compressed air or a vacuum cleaner may be used to clean dust and dirt.
Burner Cup and Orifice	Clear of obstructions (even spider webs will cause problems). Carefully remove any dust and debris from the burner.
Electrodes	Replace if there are cracked ceramics, excessive carbon residue, or erosion of the electrodes. The electrode gap should be 1/8" (3.2 mm).
Thermostat	There should be no exposed wire or damage to the thermostat. *See Page 44, Section 11*.
Suspension Points	Make sure the heater is hanging securely. Look for signs of wear on the chain or ceiling. *See Page 15, Figure 14*.
Decorative and Protective Grille (optional)	The grille must be securely attached. Check that the side reflector extensions are installed correctly and secured in place if necessary (Decorative grille only). *See Page 32, Section 8.5 and Page 34, Section 8.6* Make sure shield is installed correctly and secured in place if necessary. (Decorative grille only.) *See Page 33, Section 8.5.2*.
Lower Clearance Shield (optional)	The lower shield must be securely attached. Inspect shield support straps and lower clearance shield anchor points. Make sure shield is installed correctly and secured in place if necessary. *See Page 32, Section 8.4*.
Wall Tag	If wall tag is present, make sure it is legible and accurate. Please contact Roberts-Gordon LLC or your ROBERTS GORDON® independent distributor, if you need a wall tag. *See Page 3, Section 2.1*.

SECTION 13: TROUBLESHOOTING

⚠ DANGER



Electrical Shock Hazard

Disconnect electric before service or maintenance.

Heater must be connected to a properly grounded electrical source.

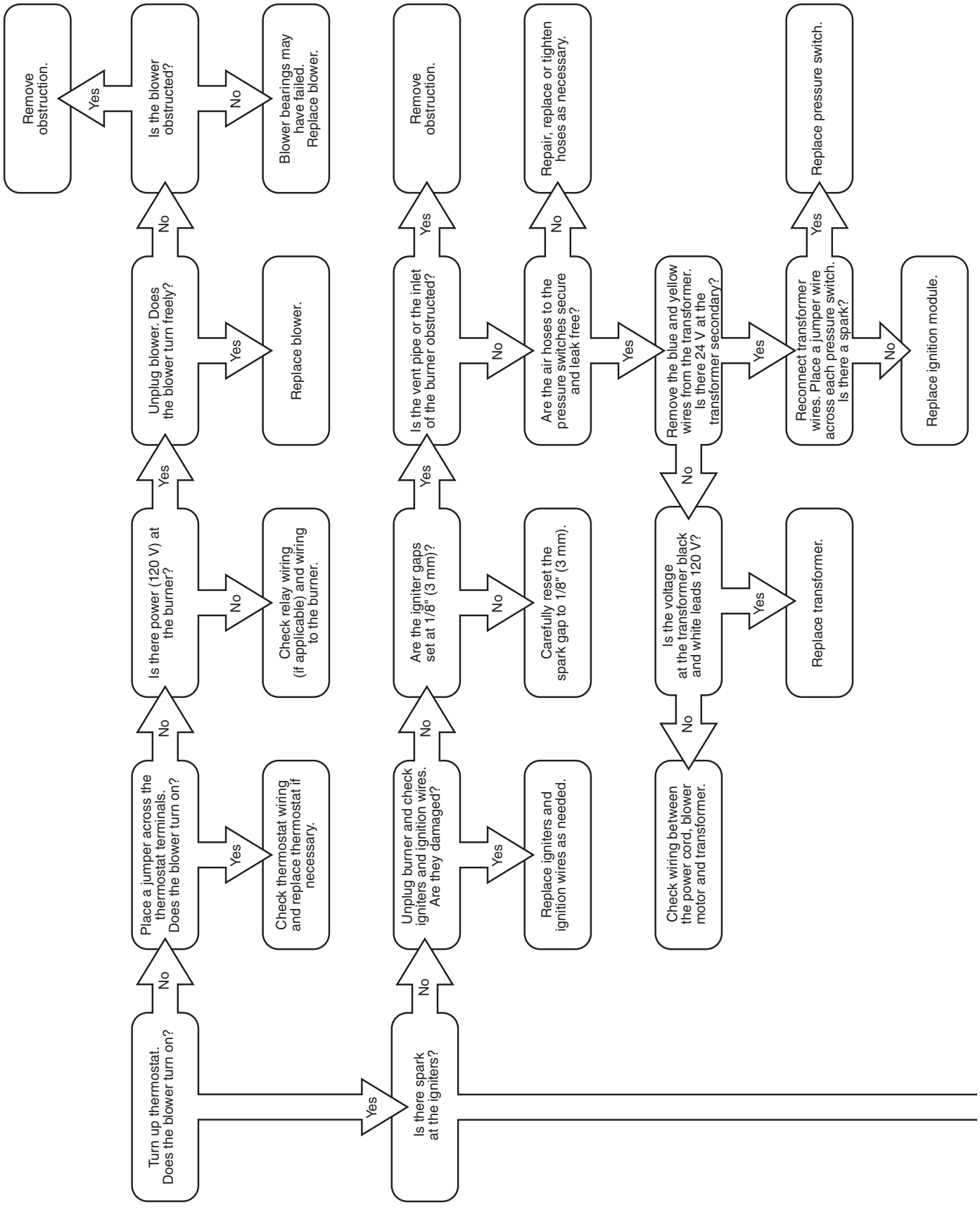
Failure to follow these instructions can result in death or electrical shock.

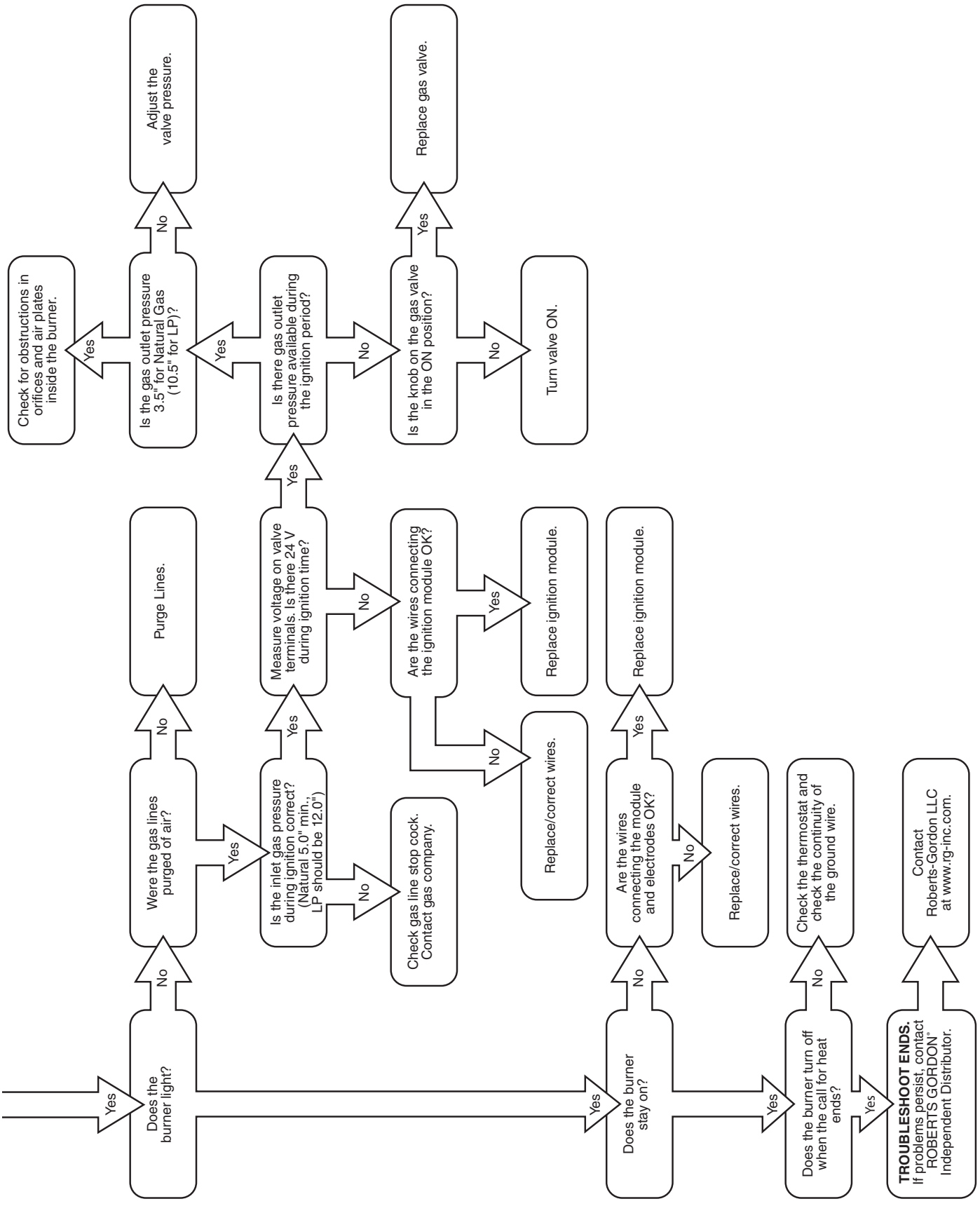
⚠ WARNING

Fire Hazard	**Explosion Hazard**	**Burn Hazard**	**Cut/Pinch Hazard**
Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from heater. **Some objects will catch fire or explode when placed close to heater.**	**Turn off gas supply to heater before service or maintenance.**	**Allow heater to cool before service or maintenance.** **Tubing may still be hot after operation.**	**Wear protective gear during installation, operation and service.** **Edges are sharp.**

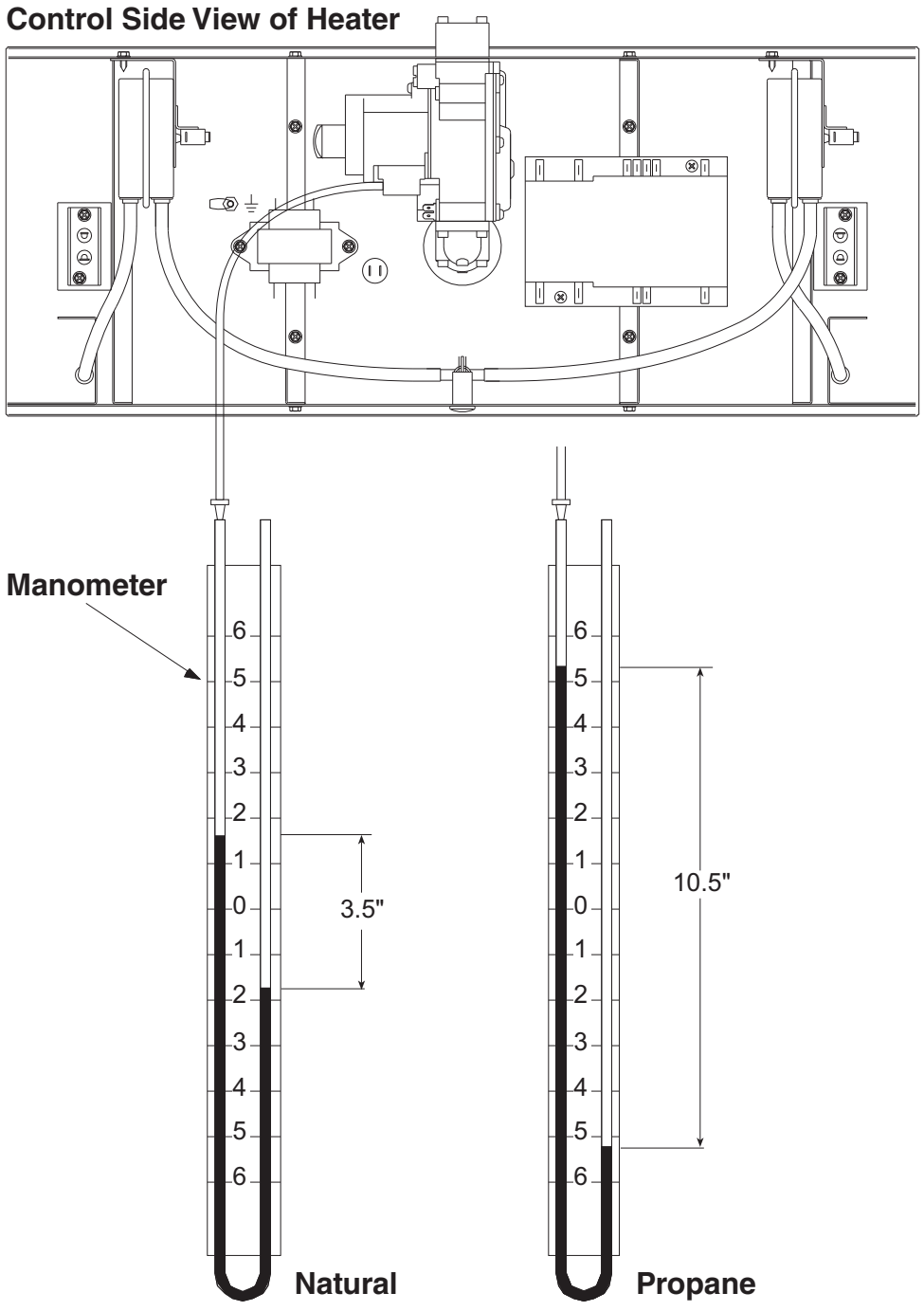
Failure to follow these instructions can result in death, injury or property damage.

13.1 Troubleshooting Flow Chart

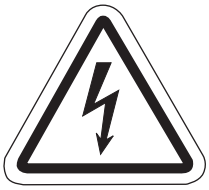

Turn up thermostat. Does the blower turn on?
No
Place a jumper across the thermostat terminals. Does the blower turn on?
No
Is there power (120 V) at the burner?
No
Check relay wiring (if applicable) and wiring to the burner.
Yes
Unplug blower. Does the blower turn freely?
No
Is the blower obstructed?
Yes
Remove obstruction.
No
Blower bearings may have failed. Replace blower.
Yes
Replace blower.
Yes
Check thermostat wiring and replace thermostat if necessary.
Yes
Is there spark at the igniters?
No
Unplug burner and check igniters and ignition wires. Are they damaged?
No
Are the igniter gaps set at 1/8" (3 mm)?
No
Carefully reset the spark gap to 1/8" (3 mm).
Yes
Is the vent pipe or the inlet of the burner obstructed?
Yes
Remove obstruction.
No
Are the air hoses to the pressure switches secure and leak free?
No
Repair, replace or tighten hoses as necessary.
Yes
Replace igniters and ignition wires as needed.
Yes
Remove the blue and yellow wires from the transformer. Is there 24 V at the transformer secondary?
No
Is the voltage at the transformer black and white leads 120 V?
No
Check wiring between the power cord, blower motor and transformer.
Yes
Replace transformer.
Yes
Reconnect transformer wires. Place a jumper wire across each pressure switch. Is there a spark?
Yes
Replace pressure switch.
No
Replace ignition module.


Does the burner light?
Yes
No
Were the gas lines purged of air?
Yes
No
Purge Lines.
Is the inlet gas pressure during ignition correct? (Natural 5.0" min., LP should be 12.0")
Yes
No
Check gas line stop cock. Contact gas company.
Measure voltage on valve terminals. Is there 24 V during ignition time?
Yes
No
Are the wires connecting the ignition module OK?
Yes
No
Replace ignition module.
Replace/correct wires.
Is there gas outlet pressure available during the ignition period?
Yes
No
Is the gas outlet pressure 3.5" for Natural Gas (10.5" for LP)?
Yes
No
Adjust the valve pressure.
Check for obstructions in orifices and air plates inside the burner.
Is the knob on the gas valve in the ON position?
Yes
No
Replace gas valve.
Turn valve ON.
Does the burner stay on?
Yes
No
Are the wires connecting the module and electrodes OK?
Yes
No
Replace ignition module.
Replace/correct wires.
Does the burner turn off when the call for heat ends?
Yes
No
Check the thermostat and check the continuity of the ground wire.
TROUBLESHOOT ENDS.
If problems persist, contact ROBERTS GORDON® Independent Distributor.
Yes
Contact Roberts-Gordon LLC at www.rg-inc.com.

13.2 Manifold Gas Pressure Setting

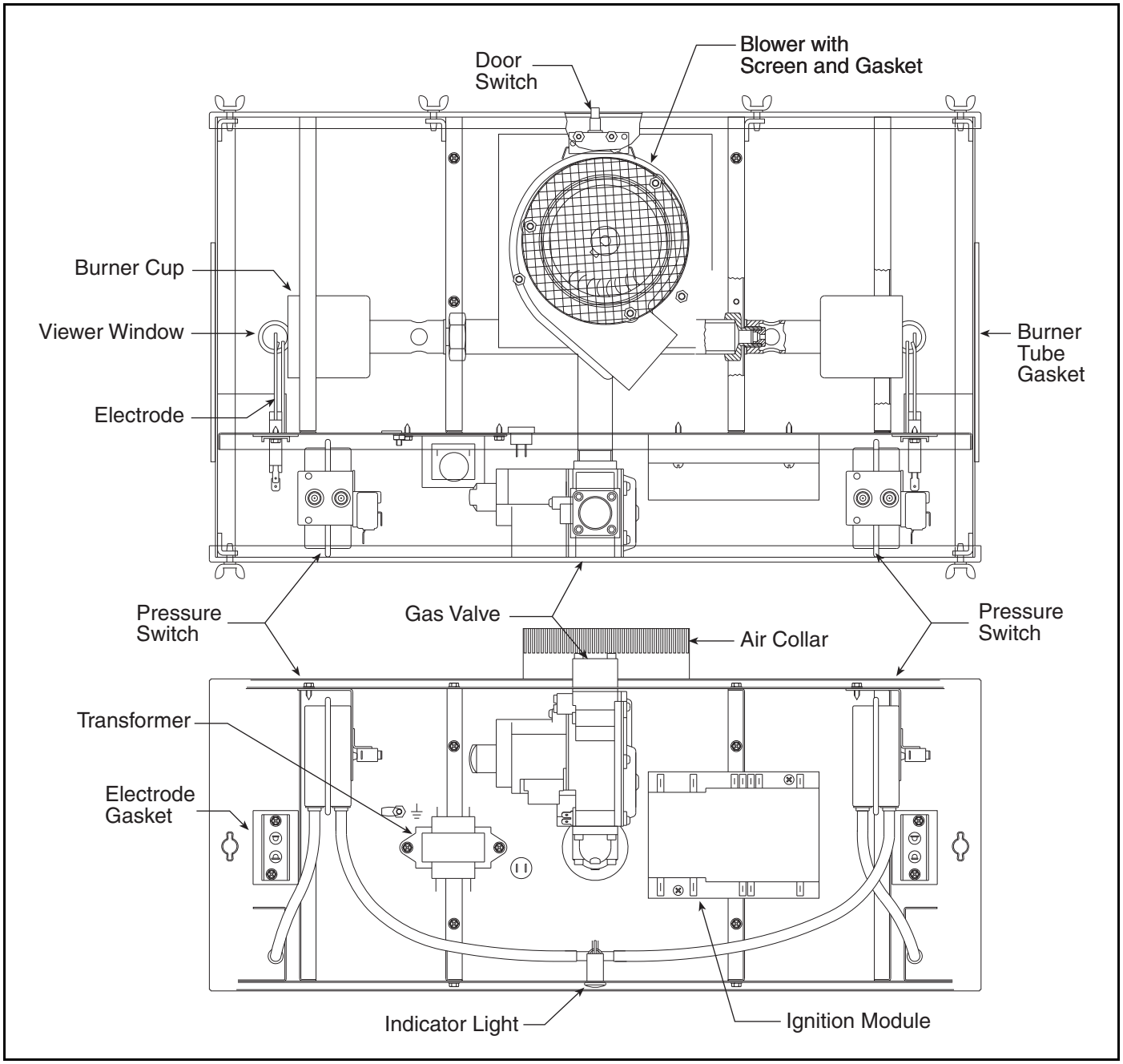


SECTION 14: REPLACEMENT PARTS

⚠ DANGER	⚠ WARNING		
			
Electrical Shock Hazard	**Explosion Hazard**	**Fire Hazard**	**Carbon Monoxide Hazard**

Use only genuine ROBERTS GORDON® replacement parts per this installation, operation and service manual.

Failure to follow these instructions can result in death, electric shock, injury or property damage.



Description	Part Number
Gas Valve (Natural)	90033700
Gas Valve Kit (LP) (consists of NG gas valve and spring conversion kit)	90033700K
Gasket:	
(160/200/250/300/350/380)	09060000
(120)	03050900
Screen	
(160/200/250/300/350/380)	09050000
(120)	03050800
Blower	
(160/200/250/300/350/380)	90710400-P
(120)	90708600-P
Burner Cup Assembly	03020100
Mica Window Assembly	02553203
Electrode	90427403
Ignition Module	90434007
Electrode Gasket	02558501
Indicator Light	91316102
Transformer	90436900K
Door Switch	90436800
Air Collar	
(160/200/250/300/350/380)	08031500
(120)	91911700
Transition Tube Gasket	02568200
Pressure Switch:	
(120/380)	90439802K
(160/200)	90439806K
(250)	90439808K
(350)	90439804K

SECTION 15: GENERAL SPECIFICATIONS

15.1 Material Specifications

15.1.1 Reflectors

.024 Aluminum
(Optional .024 Stainless Steel Type 304)

15.2 Heater Specifications

15.2.1 Ignition

Fully automatic, three-try, direct spark, electronic ignition control, 100% safety shut-off.

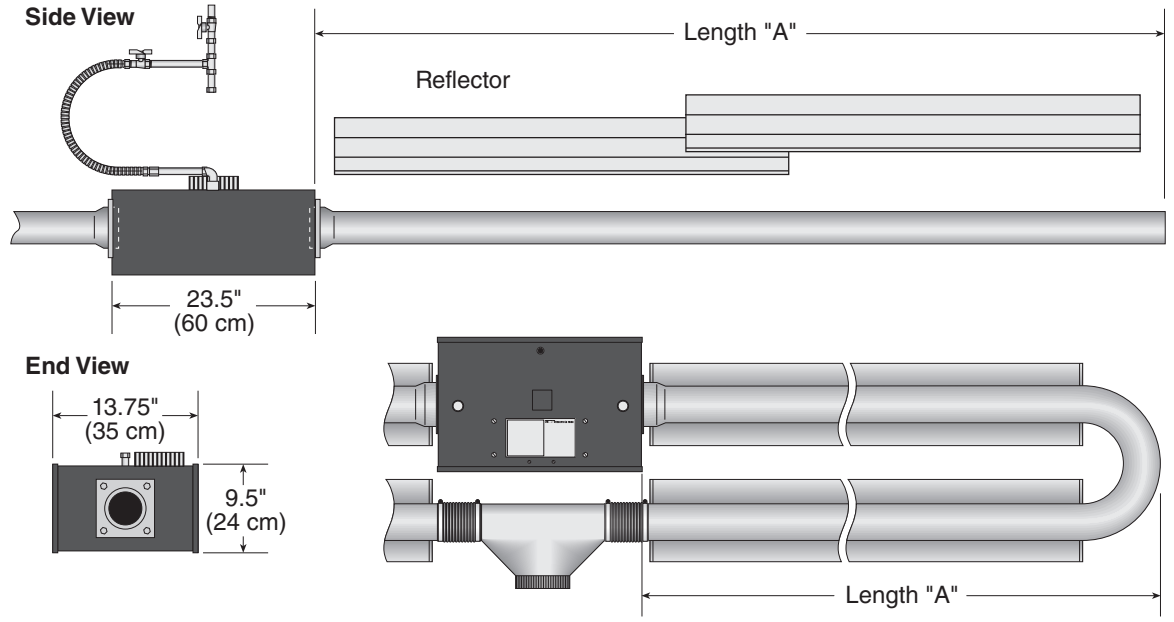
15.3 Suspension Specifications

Hang heater with materials with a minimum working load of 75 lbs (33 kg). *See Page 15, Figure 14*.

15.4 Controls Specifications

Time switches, thermostats, etc. can be wired into the electrical supply. External controls supplied as an optional extra.

General Specifications for heaters are as follows:



Model	Heat Input Rate (Btu/h) X (1000)	Length "A" Each Side Minimum Linear	Length "A" Each Side Minimum U-Tube	Recommended Minimum Mounting Height* Space	Recommended Minimum Mounting Height* Spot
TF-120	120	20' (6 m)	11'6" (4 m)	12' (4 m)	9' (3 m)
TF-160	160	20' (6 m)	11'6" (4 m)	15' (5 m)	11' (3 m)
TF-200	200	30' (9 m)	16'6" (5 m)	15' (5 m)	12' (4 m)
TF-250	250	40' (12 m)	21' 6" (7 m)	20' (6 m)	15' (5 m)
TF-300	300	50' (15 m)	26'6" (8 m)	20' (6 m)	20' (6 m)
TF-350	350	50' (15 m)	26'6" (8 m)	25' (8 m)	23' (7 m)
TF-380	380	60' (18 m)	31'6" (10 m)	25' (8 m)	23' (7 m)

**Length "A" Each Side Minimum* — Recommended Minimum Mounting Height*

See Page 4, Section 3 for clearances to combustibles.

GAS PRESSURE AT MANIFOLD:

Natural Gas: 3.5" wc
LP Gas: 10.5" wc

DIMENSIONS:

Vent Connection Size:
4" (10 cm) or 6" (15 cm)
Outside Air Connection Size:
4" (10 cm) or 6" (15 cm)
Refer to figure above for dimensional information.

PIPE CONNECTION:

3/4" NPT

GAS INLET PRESSURE:

Natural Gas: 5.0" wc Minimum
16.0" wc Maximum
LP Gas: 12.0" wc Minimum
16.0" wc Maximum

ELECTRICAL RATING (ALL MODELS):

120V - 60 Hz., 1.0 Amp

SECTION 16: THE ROBERTS GORDON® VANTAGE® TF WARRANTY

ROBERTS-GORDON LLC WILL PAY FOR:

Within 36 months from date of purchase by buyer or 42 months from date of shipment by Roberts-Gordon LLC (whichever occurs first), replacement parts will be provided free of charge for any part of the product which fails due to a manufacturing or material defect.

Roberts-Gordon LLC will require the part in question to be returned to the factory. Roberts-Gordon LLC will, at its sole discretion, repair or replace after determining the nature of the defect and disposition of part in question.

ROBERTS GORDON® Replacement Parts are warranted for a period of 12 months from date of shipment from Roberts-Gordon LLC or the remaining ROBERTS GORDON® VANTAGE®TF warranty.

ROBERTS-GORDON LLC WILL NOT PAY FOR:

Service trips, service calls and labor charges.

Shipment of replacement parts.

Claims where the total price of the goods have not been paid.

Damage due to:

- Improper installation, operation or maintenance.
- Misuse, abuse, neglect, or modification of the ROBERTS GORDON® VANTAGE® TF in any way.
- Use of the ROBERTS GORDON® VANTAGE® TF for other than its intended purpose.
- Incorrect gas or electrical supply, accident, fire, floods, acts of God, war, terrorism, or other casualty.
- Improper service, use of replacement parts or accessories not specified by Roberts-Gordon.
- Failure to install or maintain the ROBERTS GORDON® VANTAGE® TF as directed in the Installation, Operation and Service manual.
- Relocation of the ROBERTS GORDON® VANTAGE® TF after initial installation.
- The use of the ROBERTS GORDON® VANTAGE® TF in a corrosive atmosphere containing contaminants.
- The use of the ROBERTS GORDON® VANTAGE® TF in the vicinity of a combustible or explosive material.
- Any defect in the ROBERTS GORDON® VANTAGE® TF arising from a drawing, design, or specification supplied by or on behalf of the consumer.
- Damage incurred during shipment. Claim must be filed with carrier.

WARRANTY IS VOID IF:

The ROBERTS GORDON® VANTAGE® TF is not installed by an contractor qualified in the installation and service of gas fired heating equipment.

You cannot prove original purchase date and required annual maintenance history.

The data plate and/or serial number are removed, defaced, modified or altered in any way.

The ownership of the ROBERTS GORDON® VANTAGE® TF is moved or transferred. This warranty is nontransferable.

Roberts-Gordon LLC is not permitted to inspect the damaged equipment and/or component parts.

READ YOUR INSTALLATION, OPERATION AND SERVICE MANUAL

If you have questions about your equipment, contact your installing professional. Should you need Replacement Parts or have additional questions, call or write:

Roberts-Gordon LLC
1250 William Street
P.O. Box 44
Buffalo, New York 14240-0044
716.852.4400
On the web at: www.rg-inc.com

Roberts-Gordon LLC's liability, and your exclusive remedy, under this warranty or any implied warranty (including the implied warranties of merchantability and fitness for a particular purpose) is limited to providing replacement parts during the term of this warranty. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you. There are no rights, warranties or conditions, expressed or implied, statutory or otherwise, other than those contained in this warranty.

Roberts-Gordon LLC shall in no event be responsible for incidental or consequential damages or incur liability for damages in excess of the amount paid by you for the ROBERTS GORDON® VANTAGE® TF. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

Roberts-Gordon LLC shall not be responsible for failure to perform under the terms of this warranty if caused by circumstances out of its control, including but not limited to war, fire, flood, strike, government or court orders, acts of God, terrorism, unavailability of supplies, parts or power. No person is authorized to assume for Roberts-Gordon LLC any other warranty, obligation or liability.

LIMITATIONS ON AUTHORITY OF REPRESENTATIVES:

No representative of Roberts-Gordon LLC, other than an Executive Officer, has authority to change or extend these provisions. Changes or extensions shall be binding only if confirmed in writing by Roberts-Gordon LLC's duly authorized Executive Officer.

ROBERTS GORDON
Infrared Heating

OWNER WARRANTY REGISTRATION CARD

Mail or Fax to:

Roberts Gordon LLC •1250 William Street, P.O. Box 44 • Buffalo, NY 14240-0044 • Phone: 716-852-4400 • Fax: 716-852-0854
Toll Free: 800-828-7450 • www.rg-inc.com

About the Owner:

Name:_____

Address:_____City:_____State:_____Zip Code:_____

Phone:_____ Fax:_____ E-mail:_____

About the Installer:

Name:_____

Address:_____City:_____State:_____Zip Code:_____

Phone:_____Fax:_____E-mail:_____

Purchased From (if different than installer):

Name:_____

Address:_____City:_____State:_____Zip Code:_____

Phone:_____ Fax:_____ E-mail:_____

About your Heater:

Model#:_____ Serial #:_____ Fuel:_____Installation Date:_____

Type of Installation (check one):

o Automotive	o Manufacturing	o Warehouse	o Recreational	o Aircraft
o Public Building	o Office	o Retail	o Agricultural	o Other_____

Installation Code and Annual Inspections: All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment.

To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

These products are not for residential use.

This product is intended to assist licensed professionals in the exercise of their professional judgment.

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Attach this information to a wall near the ROBERTS GORDON® heater.

ROBERTS GORDON®
Infrared Heating

Read the Installation, Operation, and Service Manual thoroughly before installation, operation, or service.

Know your model number and installed configuration.

Model number and installed configuration are found on the burner and in the Installation, Operation and Service Manual.

Write the largest clearance dimensions with permanent ink according to your model number and configuration in the open spaces below.

OPERATING INSTRUCTIONS

1. STOP! Read all safety instructions on this information sheet.
2. Open the manual gas valve in the heater supply line.
3. Turn on electric power to the heater.
4. Set the thermostat to desired setting.

TO TURN OFF THE HEATER

1. Set the thermostat to off or the lowest setting.

IF THE HEATER WILL NOT OPERATE, TO ENSURE YOUR SAFETY, FOLLOW THESE INSTRUCTIONS TO SHUT DOWN YOUR HEATER

1. Set the thermostat to off or the lowest setting.
2. Turn off electric power to the heater.
3. Turn off the manual gas valve in the heater supply line.
4. Call your registered installer/contractor qualified in the installation and service of gas-fired heating equipment.

⚠WARNING

Fire Hazard

Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from heater.

Some objects will catch fire or explode when placed close to heater.

Failure to follow these instructions can result in death, injury or property damage.

Maintain_____clearance to the side and _____ clearance below the heater from vehicles and combustible materials.

Roberts-Gordon LLC
1250 William Street
P.O. Box 44
Buffalo, NY 14240-0044 USA
Telephone: 716.852.4400
Fax: 716.852.0854
Toll Free: 800.828.7450

Roberts-Gordon Europe Limited
Unit A, Kings Hill Business Park
Darlaston Road, Wednesbury
West Midlands WS10 7SH UK
Telephone: +44 (0)121 506 7700
Fax: +44 (0)121 506 7701

Service Telephone: +44 (0)121 506 7709
Service Fax: +44 (0)121 506 7702
E-mail: uksales@rg-inc.com
E-mail: export@rg-inc.com

Installation Code and Annual Inspections:
All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through ROBERTS GORDON® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

This product is not for residential use.

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